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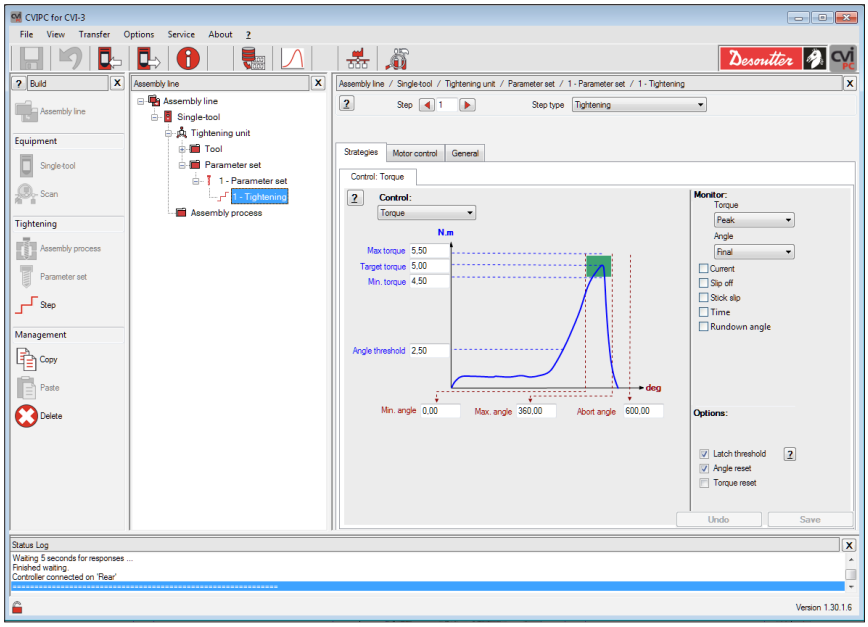
CVIPC

V 1.30.1.9

User manual



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1 - SAFETY AND STATEMENT OF USE

This product is intended to program and configure CVI3 controllers.

No other use permitted.

For professional use only.

General safety instructions and installation of controllers and electric spindles are collected in the "Quick start user manual" part no. 6159932290_02.

SAVE THESE INSTRUCTIONS CAREFULLY.

2 - INSTALLATION

The PC minimum configuration is:

- Windows 2000 SP1 minimum
- 150 Mo available on hard disk
- Monitor resolution 1280 x 1024
- Administrator rights required for installation

- Insert the supplied CDrom.
- If "AutoRun" is activated on your PC, click on "Install CVI3".
- If "AutoRun" is disabled, double-click on the drive and click on CVI3 icon.

- Click "Contact us" to display our headquarters address and phone numbers as well as our website.
- Click "User manual" to display the literature available on the CDrom.

2.1 - CVIMONITOR installation

This version of CVIMONITOR can be run in standalone.

- Click "Install software" then CVIMONITOR to launch the setup wizard. You will be asked to select the language to be used by the installation wizard.
- Follow the instructions until you click on "Finish".

At program startup, a scan is automatically performed to detect the connected controllers.

- Select the IP address of the controller you want to monitor:
- For more information about CVIMONITOR, refer to the user manual.

2.2 - CVIPC installation

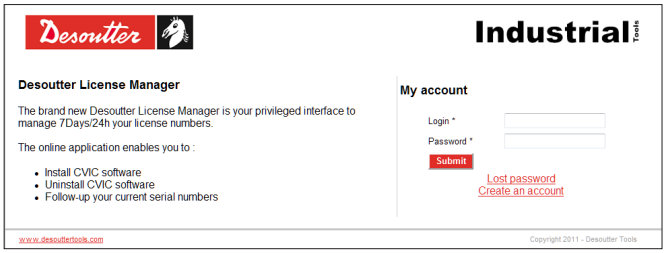
- Click "Install software" then CVIPC to launch the set up wizard.

If CVIPC is already running on your computer, a maintenance program will be displayed and you will be allowed you to modify, repair or remove CVIPC software.

- If not, follow the instructions until you click on "Finish".

2.2.1 - How to register your licenses

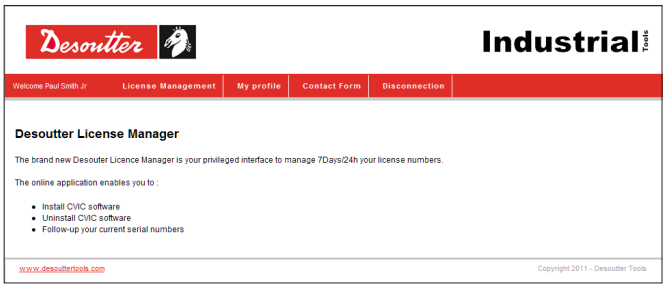
- Go to the website "https://licensing.desouttertools.com/"



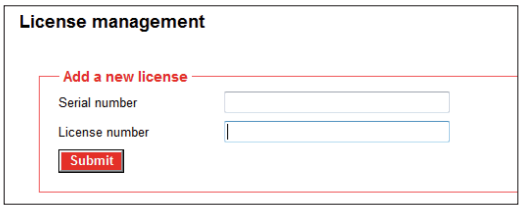
- Create your own login and password as you like.
- Click on "Submit".

Your account has been created.

You will receive your login and password by e-mail.



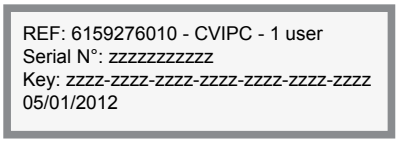
License Management	• Click this icon to view the following screen.



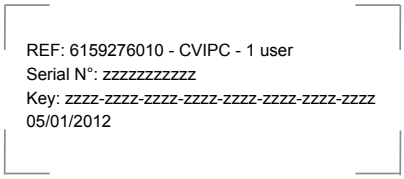
- Enter the serial number
- Enter the key or license number.

You will find them:

- on the label of the CDrom



- or on the back page of the cover

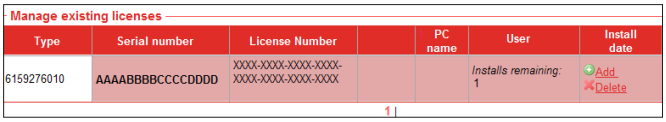


- Click on "Submit" to validate.

2.2.2 - How to activate your CVIPC

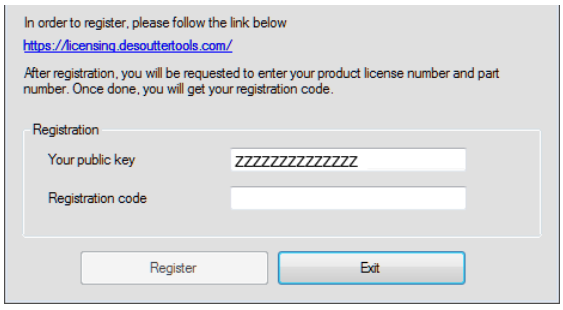
- Login to the website "https://licensing.desouttertools.com/".

License Management	• Click this icon to view the following screen.

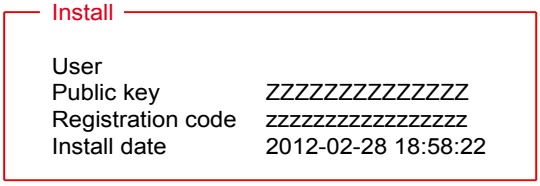


- Click on "Add" to get your registration code.

- Copy/paste the public key you will get as follows:
  - Launch CVIPC.
  - In the Menu area, click on "Service" and then "Registration" to display the following screen.



- Click on "Submit" to validate.



Now you get the registration code that you need to activate on the target PC in the CVIPC/Service/Registration menu.

In this example, CVIPC is to be used for 1 user. If you buy 5 licences, you will have to register CVIPC once and activate the registration code on 5 different PCs.

Contact Form	• In case of any problem, click this icon to contact Desoutter support.

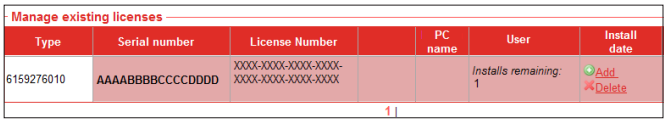
2.2.3 - How to uninstall CVIPC

- Click Start, click Control Panel, and then double-click Add or Remove Programs.
- In the Currently installed programs box, click the program that you want to remove, and then click Remove.
- If you are prompted to confirm the removal of the program, click Yes.

2.2.4 - How to unregister your license

- Login to the website "https://licensing.desouttertools.com/".

License Management	• Click this icon to view the following screen.



- Click on "Delete" to suppress your registration code.

- Tick "Other reason" and add a comment to explain why you want to uninstall your licence.
- Click on "Submit" to validate.
- Please wait for a message from Desoutter support confirming that your license has been unregistered. You will then be able to reactivate the license on a new PC.

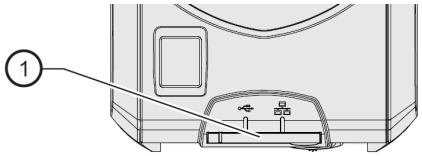
2.3 - Communication with controllers

The PC must be connected to the controller(s) via a "Point to point" OR a network connection.

2.3.1 - Point to point

Pre-requisite:
The PC Ethernet card must be configured in DHCP.

The PC is directly connected to the controller on the dedicated Ethernet port on the front panel. Communication parameters are automatically set.

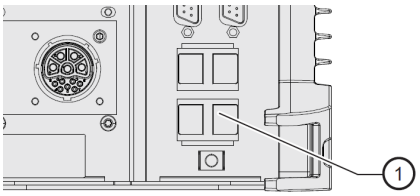


Legend
1 Ethernet port dedicated to CVIPC only.

- Connect the PC on the port.

2.3.2 - Ethernet networks

The PC and the controllers are connected to the Ethernet network.

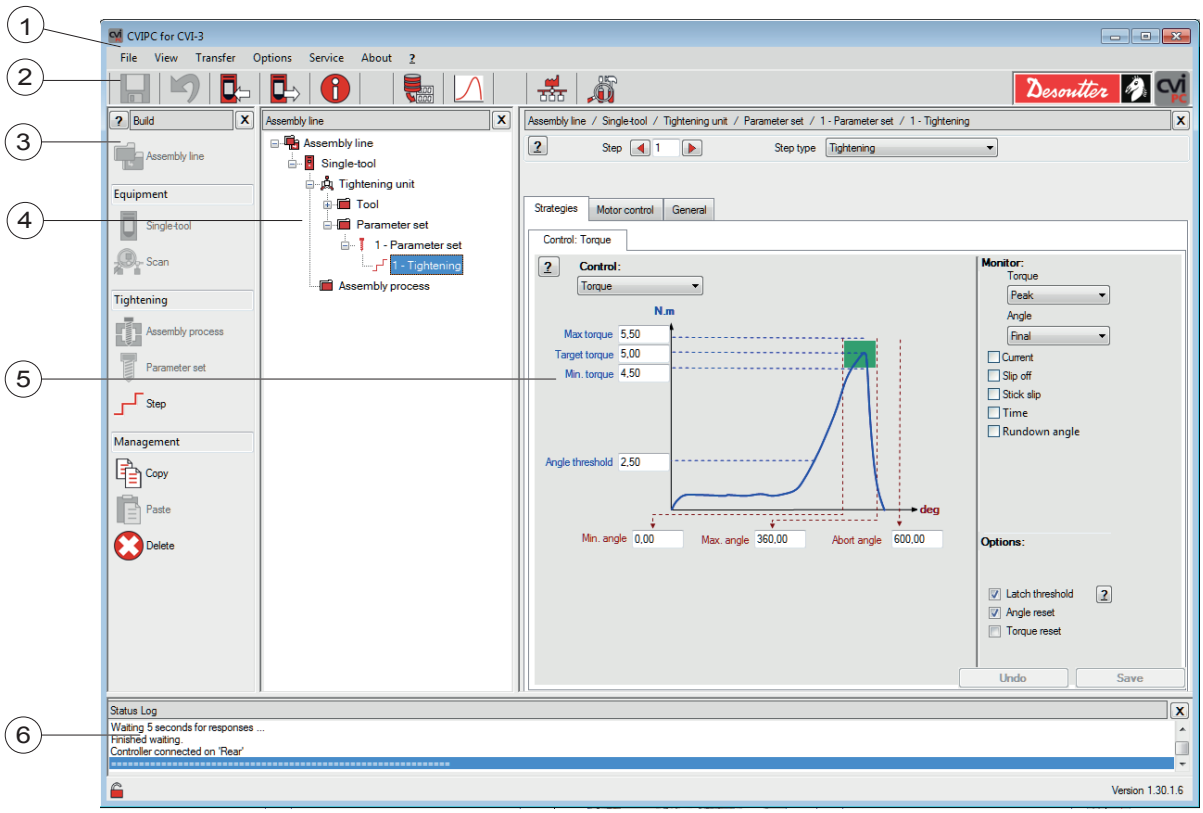


Legend
1 Embedded Ethernet switch 4 ports

- Connect the PC according to the following description.
- To set up the parameters, refer to the controller's manual operator or contact your Desoutter representative for support.

1 network		Plug your Ethernet cable into any port.
2 networks		Ethernet network 1
		Ethernet network 2

3 - OVERVIEW



Legend

1 Menu area
2 Tool bar
3 Assembly line build area
4 Assembly line tree view
5 Details
6 Log area

Use this key to view the user guide.

The open padlock shows that all displays and settings are available for anybody. Contact your CVIKEY administrator for support.

Version 1.30.1.9 — Current software version.

Buttons + / − — Click these buttons to collapse or expand the trees.

How to quit CVIPC — Click "Exit" in the Menu area.

4 - READ BEFORE STARTING

In a network connection mode, settings and programmings made in CVIPC will be effective in the controllers only when data are transferred from the PC to the controllers.

Only one user is allowed to make changes at once i.e. if someone is modifying one controller, the user CVIPC connected to the same controller is not allowed to make changes. This is the case for several CVIPC connected on the same controller.

5 - MENU AREA

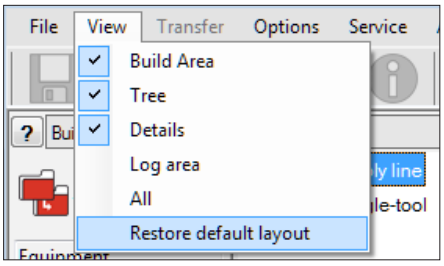
This area leads to:

- View management
- Options: language, e-mail configuration, preferences
- Information about the current software version
- Display of the user manual.

The other topics such as data back-up, data transfer and service are covered in most relevant sections.

5.1 - View management

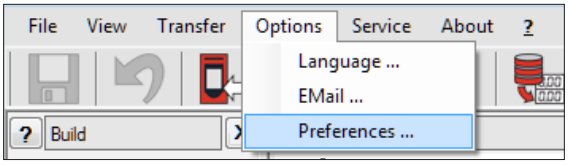
The view menu allows to adapt the display to the user needs.



Sub-menu	Description
Build area	The build area serves as a tool box to create Assembly lines, associate equipments to the Assembly line, set the tightening process and allows the process management.
Tree	The tree area shows the current configurations. It displays the architecture of the assembly groups, the controllers, the tools and the tightening parameters.
Details	The detail area displays the details belonging to the item selected in the tree area. To set the parameters for the item selected in the tree area.
Log area	History view Display in real-time.

- Tick the selected area or all areas to display the views at your convenience.
- In case of any problem, tick "Restore default layout".

5.2 - Options

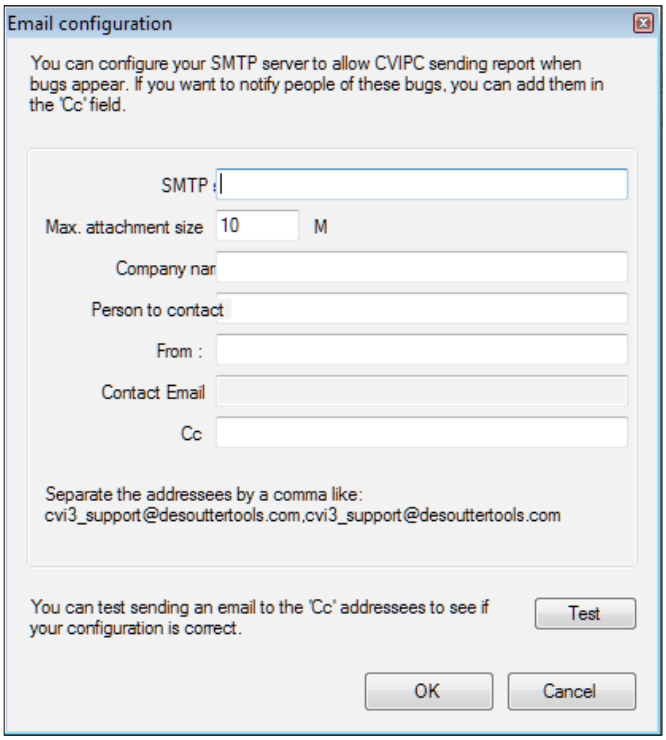


5.2.1 - Language

The language by default is "English".

- Select your own language and click on "Change"
- Click on File/Exit to close CVIPC and re-start the program to display the new language.

5.2.2 - E-mail configuration



- Point your SMTP server to allow CVIPC sending report when bugs appear.

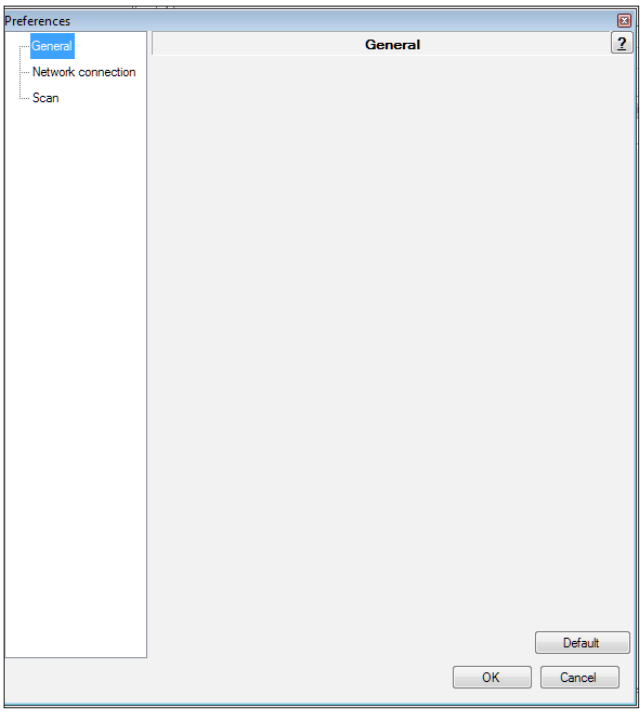
Max. attachment size: 10 M by default.

- If you want to notify people of these bugs, add their e-mails in the "Cc" field. Separate the addresses by a comma.
- Click on "Test" to check that your configuration is correct.
- Save and quit by pressing OK.

5.2.3 - Preferences

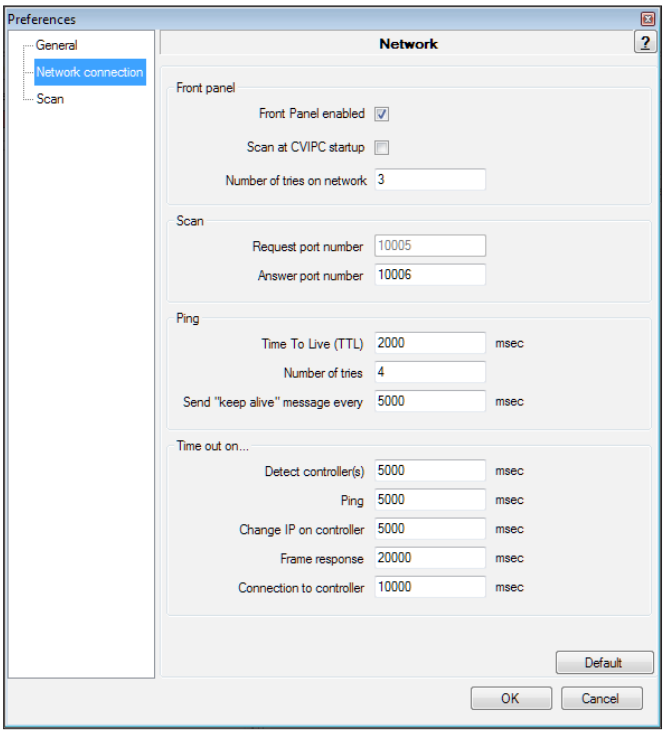
5.2.3.1 - General

The general settings of CVIPC are displayed:



- Click on "Default" to restore the initial values.

5.2.3.2 - Network connection

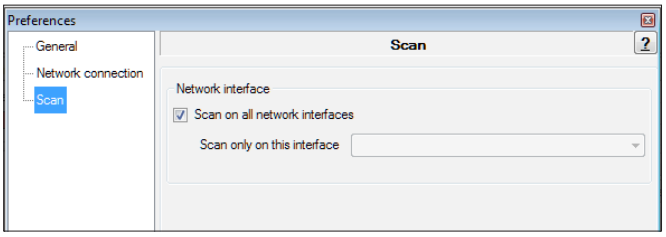


- "Front panel enabled"
  If you want to prevent users from connecting on the controller front panel, uncheck this box.
- Tick "Scan at CVIPC startup" to automatically scan the network and display all the controllers available at CVIPC launch.

The "Scan, Ping and Timeout on" values are configured by default.

- Click on "Default" if you want to restore the initial values.
- Save and quit by pressing OK.

5.2.3.3 - Network or single controller scanning



- Choose if you want to scan the controllers on all network interfaces or on a specific interface.
- Click on "Default" if you want to restore the initial values.
- Save and quit by pressing OK.

5.3 - About

This menu displays the current software version.

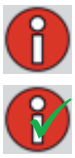
To update CVIPC software, please contact your Desoutter representative for support.

5.4 - Help ?

- Click the question mark to display the user manual.

6 - TOOL BAR

In this area, you will find the means to manage your work.

	Save	Use this icon to save the modifications in the database.
	Undo	Use this icon to return to the previous status
	Data transfer from the PC	Use this icon to transfer data from the PC to the controller
	Data transfer from the controller	Use this icon to transfer data from a controller to the PC
	Information	Use this icon to get information about the controller and the tools. When the controller is connected, the icon is completed with a green tick.
	Results and statistics	Use this icon to display results and statistics. To display the result of a particular controller, select it first in the tree area.
	Curve collection and display	This tool opens a menu to display the curves which have been transferred from the controllers. To display the curves of a particular controller, select it first in the tree area.
	Fieldbus	Dynamic Fieldbus mapping Click on this icon to start the Fieldbus mapper application. Refer to CVIPC user manual to get more information about the Fieldbus modules installation.
	Maintenance	Click on this icon to open CVIMonitor software which offers you to monitor results and curves in real-time, maintenance, trouble-shooting and user information history.

7 - ASSEMBLY LINE BUILD AREA

In this area, you will find the means to build your assembly processes, ie tools and tightening programs.

7.1 - Assembly line

	An assembly line is a group of tightening devices which are executing simple or complex tightening operations.

7.2 - Equipment

Equipment means tools and controllers.

It is composed of 1 single-tool as a minimum.

A single-tool represents the controller:

	CVI3 Vision
	CVI3 Function

A single-tool is composed of tightening units.

	A tightening unit associates one tool with one ore more Psets. or A tightening unit is a group of spindles working synchronously.

 *Each single-tool has its own environment (user interface, networks, etc...)*

A tightening unit is composed of tools:

	1 or 2 tools Each tool will run according to its own program. All CVI3 range tools can be connected. CVI II range tools can also be connected providing they are equipped with the CVI II adaptor.

7.3 - Tightening

7.3.1 - Assembly Process

	An Assembly Process is commonly called AP and shown by this icon.

- A "Simple Assembly Process" is made of 1 Parameter set repeated n times. The batch is the number of times the Parameter set is repeated.
- An "Advanced Assembly Process" is a sequence of actions to run a complete assembly.

The Assembly Process describes the workflow to assemble two parts and has 3 phases:

Start conditions	Identification of the pieces to assemble, selection of the process by IO, Fieldbus.
Process actions	Sequence of tightenings which is using Psets as tightening recipes.
Post processing	e.g. repeat, tool locking.

Each Assembly Process includes a maximum of 99 actions.

7.3.2 - Parameter set

	A Parameter set is commonly called Pset and shown by this icon.

A PSet is combining one or several steps, each step describing a function. The tool will execute the steps one after the other in the given order. Content of the steps and their order can be changed at any time.

The minimum to run the tool is 1 Pset containing 1 step.

There are up to 250 Psets per Tightening unit.

7.3.3 - Step

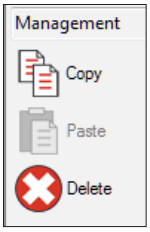
	A step is shown by this icon.

A Parameter set is composed of one or several steps, up to 15 steps per Pset.

Generally, for the tightening steps:

- Strategies covers control of target values, safety values, tolerance values, monitoring and options.
- Motor control deals with the way the target is reached, acceleration, rundown speed, speed strategy, etc...
- General parameters cover the general parameters for each step. The default values are generally convenient.

7.4 - Management

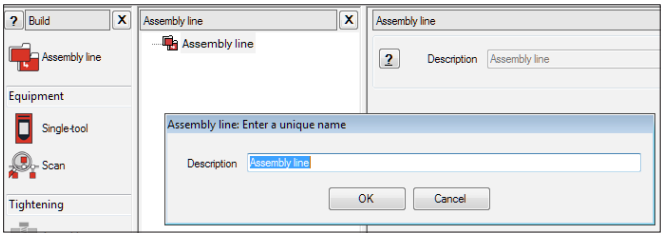
	Use Copy and Paste to duplicate items. Use Delete to suppress one or more items.

7.5 - Yellow and red messages

	The value is out of the recommended values
	The value is out of mandatory values

8 - ASSEMBLY LINE PROGRAMMING

The first action to do is create an Assembly line.



- Click on "Assembly line" in the Build tree and enter an unique name (up to 40 characters).
- Click on "Change" to customize the comment (up to 100 characters).

The next step is to configure the controllers and tools.

If the controllers are already connected to the network, use the "Scan" icon to get all data and re-arrange them if necessary.

If not, click on the "Single-tool" icon to configure your controllers and tools and proceed as described in the following chapters.

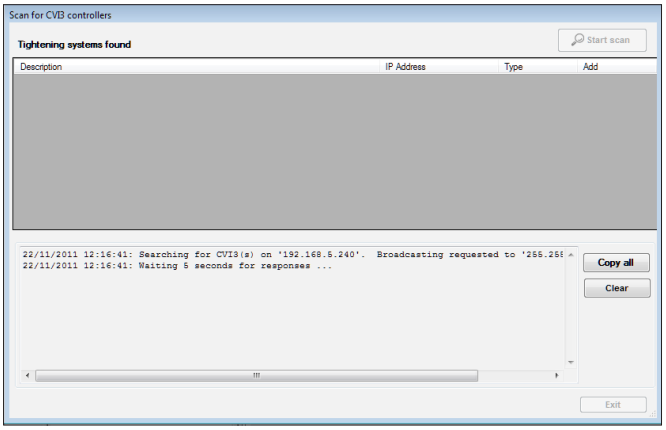
9 - HOW TO SCAN

- Before starting, refer to chapter "Menu area/Options/ Preferences" to decide the extent of the scan (whole network or specific controller).

CVIPC is able to scan all networks and collect information from the controllers.

Connected controllers are then imported in the Assembly line build tree as single-tools.

	Click this icon to start the scan process.



- Select a controller in the list and click on "Add" to copy it in the tree view of the selected Assembly line.
- Or click on "Copy all" to add the connected controllers in the tree view. It will be now possible to re-order them per Assembly line and re-set them if necessary.
- Click on "Clear" to erase the screen before starting a new scan.
- Click on "Exit" to quit the screen.

10 - SINGLE-TOOL CONFIGURATION

This screen will allow you to adjust the settings of your work environment:

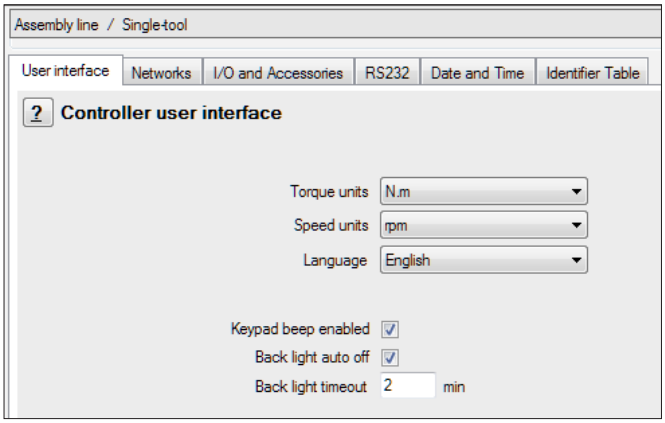
- user interface
- networks
- I/O and accessories
- RS232 and USB ports
- date and time
- identifier tables

- Click on "Single-tool".
- Enter an unique name (up to 40 characters), the controller model and the tool model.

Each single-tool configuration has its own features.

10.1 - User interface

- Select the following parameters:



Torque unit	Nm, ft lb, in lb, kg m, kg cm, oz in.
Speed unit	rpm % of max tool speed
Language	English by default
Keypad beep enabled	If selected, this function enables a "Beep" sound each time a key is pressed.
Back light auto off	The screen will be automatically turned off after the timeout. The screen will turn on as soon as: - the screen is touched for the CVI3 Vision - a key pressed for the CVI3 Function - the tool trigger is activated.
Back light timeout	The timeout value for the automatic back light switching off can be set between 1 and 99 min.

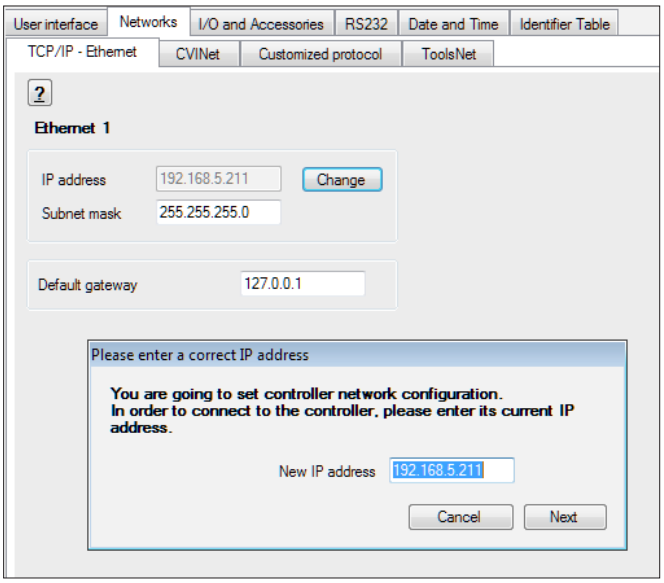
- Save and quit by pressing the Save icon.

10.2 - Networks

- Please refer to chapter "Ethernet networks" at the beginning of this manual.
- Select the type of network and fill in the requested information.

Below are the main information you may need to fill in the screens.

10.2.1 - IP address



The IP address (Internet Protocol address) is an unique address that electronic devices use for identification and communication with each other on a computer network using the Internet Protocol (IP) standard.

The controller will obtain its IP address via a DHCP server.

- If "Obtain an IP address automatically" is selected, this function scans the network, allowing for an easy set up of the network. The controller automatically finds the IP address, etc. The controller must be connected to the network before selecting the option. This function is only possible with one Network. When 2 networks are configured, one can be selected as being automatic. The other one needs to be configured manually.
- If "Use the following IP address" is selected, data have to be entered manually.

10.2.2 - Default gateway

The default gateway is a node that serves as an entrance to another network.

10.2.3 - Subnet mask

It is used in conjunction with the network address to determine which part of the address is the network address and which part is the host address.

10.2.4 - Network name

By default, the network name is "CVI3".

10.2.5 - Data collection

- Select the data you want to collect:
- Results
- Curves for good tightenings
- Curves for rejected tightenings.

10.2.6 - FIFO settings

The controller regularly sends results to CVINet and erases the same results from the controller memory, as soon as they have been sent.

The purpose is to provide a full traceability.

- Block if FIFO full: when enabled, the tool will get blocked when the result memory is full. The data collection will not work any more and data may get lost. To avoid such a blocking situation, an alarm threshold can be set in number of tightenings before the FIFO is full (50 by default).

- Save and quit by pressing the Save icon.

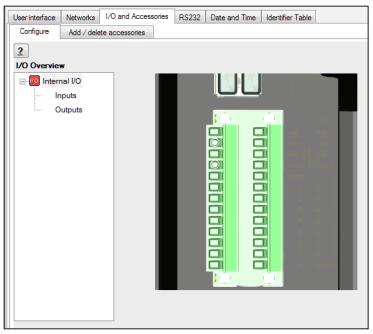
10.3 - I/O and accessories

10.3.1 - I/O management

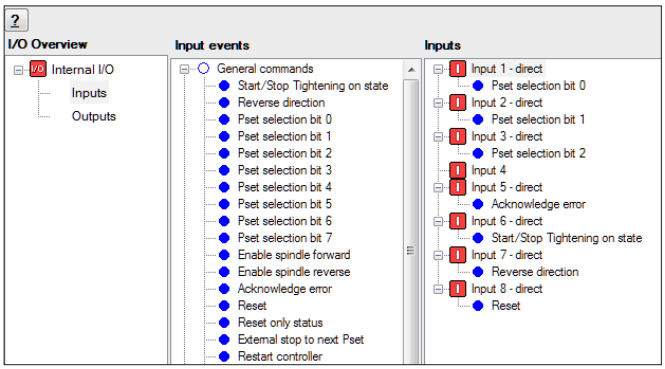
- Click on "Configure" to display the I/O.

The goal is to associate I/O events to the controller I/O.

I/O	Click this icon to display the controller I/O connector.



10.3.1.1 - Inputs

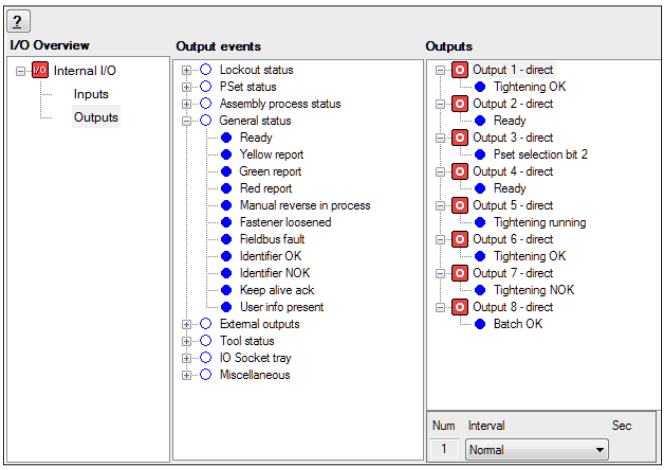


- Click on "Inputs" in the I/O Overview to display the input events and the physical inputs. Some of the most frequently used events are already assigned.
- Drag an event from the left and drop it to the right to assign an event.
- Drag and drop to the left to remove an assignment.
- In the list of I/O events, click right on the event to see its assignment
- In the list of I/O, click right on an input to select the signal direction:

Direct	Inputs and events follow the same direction
Not	Input is inverted compared to the event.

- Click on "Set defaults" to restore the initial configuration.

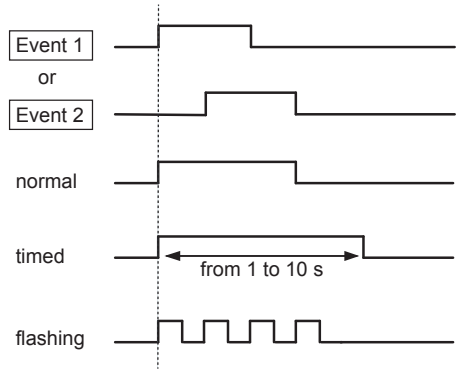
10.3.1.2 - Outputs



- Refer to the previous chapter to know how to assign an event to an output.
- Click right on the output to select the logical operation: or (by default)/and/nor/nand.
- Click on the ouput number and select the type of interval:

Normal	The output is maintained until one of the events changes.
Timed	The output is maintained during 10 s max.
Flashing	The type of interval is the same as "Normal" and flashing (375 ms on/375 ms off)

For example:



- Click on "Set defaults" to restore the initial configuration.

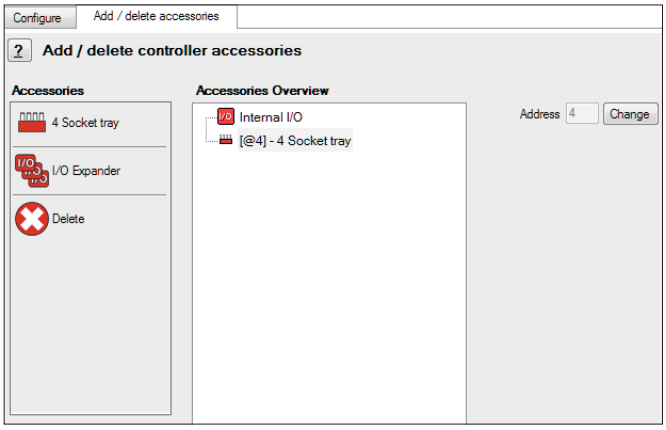
Refer to "APPENDIX - CVI3 I/O AND EVENTS" to get more information about the I/O and events

- Save and quit by pressing the Save icon.

10.3.2 - Add/delete accessories

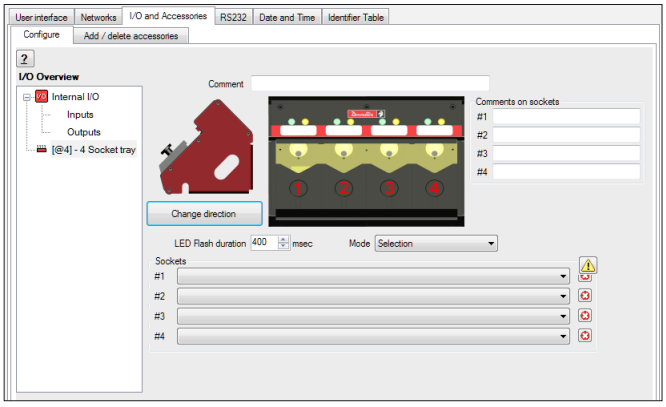
Accessories connected to the controllers can be added to the list of inputs events and assigned to physical inputs.

- Click on "Add/delete accessories" to display the screen.



- Select an available accessory by clicking on its name. It will be immediately displayed in the overview of accessories
- If needed, change the accessory address on the eBus between 0x0 and 0xF.
- To remove an accessory, select it in the Accessories/ Overview" and press "Delete".
- Once the accessories are selected, return to the previous screen by clicking on "Configure". The new accessory is now listed in the I/O Overview and can be assigned to an input.
- Click twice on the new accessory in the "Accessory overview" to set it up.
- Save and quit by pressing the Save icon.

10.3.3 - Socket tray configuration



- Change the socket tray direction according to the positioning of the LEDs. Note that the LED no. 1 is always the first left.
- Select the LED flash duration: up to 1 s.
- Enter a comment for each socket.
- Select the socket tray mode according to your assembly configuration. There are 3 modes:

10.3.3.1 - Selection mode

The controller automatically selects the Pset associated to the lifted socket.
The red LED is on when the socket is lifted and the green LED is on when the tool is ready to operate.

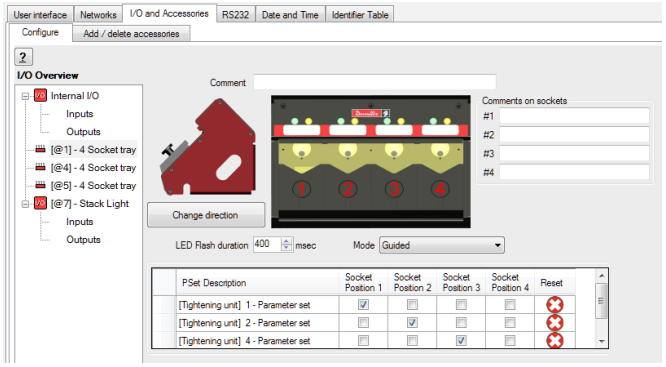
- Ensure that the controller is set in the "Pset running mode" and that the "Pset selection source" is "Socket tray" (see chapter "Tightening unit configuration".
- In the table, assign a Pset to each socket.

	Click this icon to delete your selection.

10.3.3.2 - Guided mode

The operator's task is guided either by the Pset selection or by the Assembly action of the Assembly Process.
The color code remains the same: when the Pset is selected, the green LED of the corresponding socket is blinking. Once the socket is lifted, the red LED is on. When the green LED is steady, the tool is ready to operate.

Pset selection:



- Tick one socket position per Pset.

	Click this icon to delete your selection.

Assembly action selection:

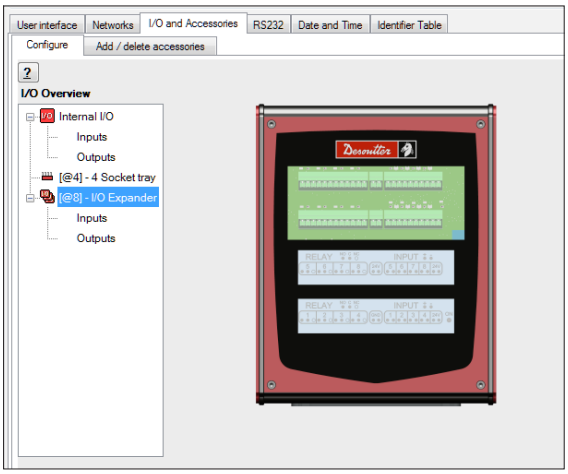
- Refer to chapter ""Assembly action", page 30.

10.3.3.3 - External mode

The socket tray is controlled by the customer protocol. LEDs are flashing or lit according to that protocol.

- Save and quit by pressing the Save icon.

10.3.4 - I/O expander configuration



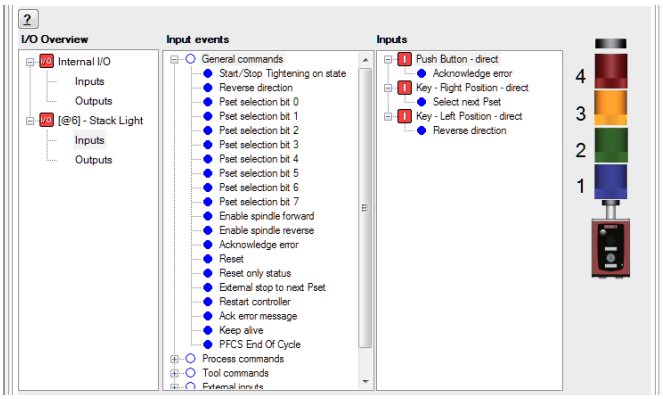
The I/O expander has 8 Input and 8 output which can be configured as standard physical I/O.

- Save and quit by pressing the Save icon.

10.3.5 - Stacklight configuration

The stacklight has 3 Input and 5 output which can be configured as standard physical I/O.

10.3.5.1 - Inputs

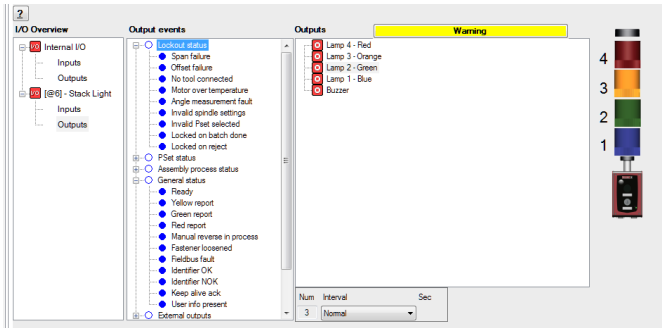


There are 3 inputs:

- Push-button
- Key - right position
- Key - left position

- Assign an input event to each output.

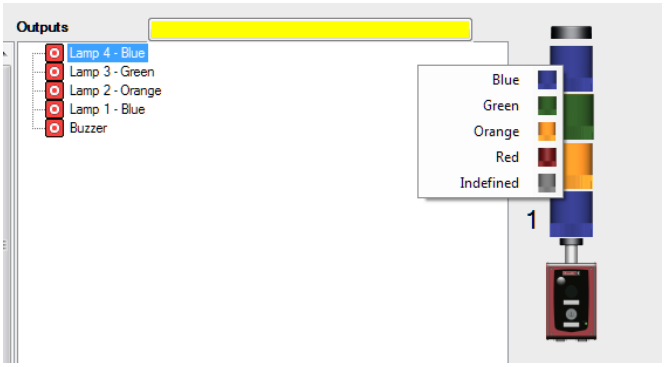
10.3.5.2 - Outputs



There are 5 outputs:

- Lamp 4
- Lamp 3
- Lamp 2
- Lamp 1
- Buzzer

- Select the color of the LEDs by clicking with the right click on the stacklight picture.

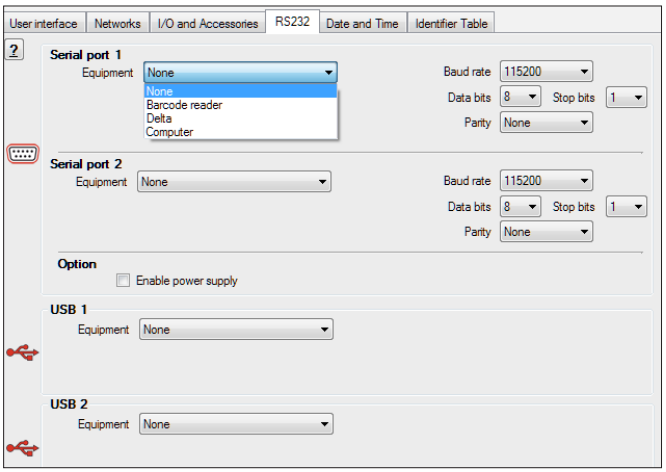


- Assign an output event to each output.

	***Changing output settings can affect actuators connected to the controller.***

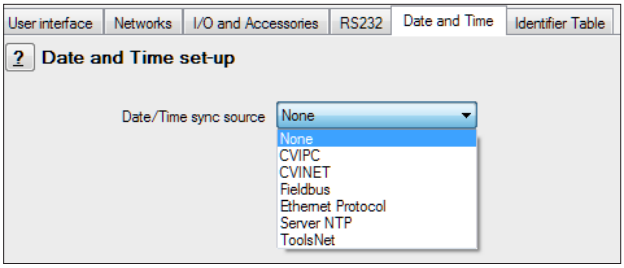
- Save and quit by pressing the Save icon.

10.4 - RS232 serial port/USB ports



- Select an equipment for each serial port and fill in the data required for the exchange.
- In case of a computer or serial printer, select the "Report format": PC4 or CS5700.
- Click "Enable power supply" to provide 5V to a barcode reader for example.
- Select the equipment to connect to the USB ports. The setting is done automatically.
- Save and quit by pressing the Save icon.

10.5 - Date and time



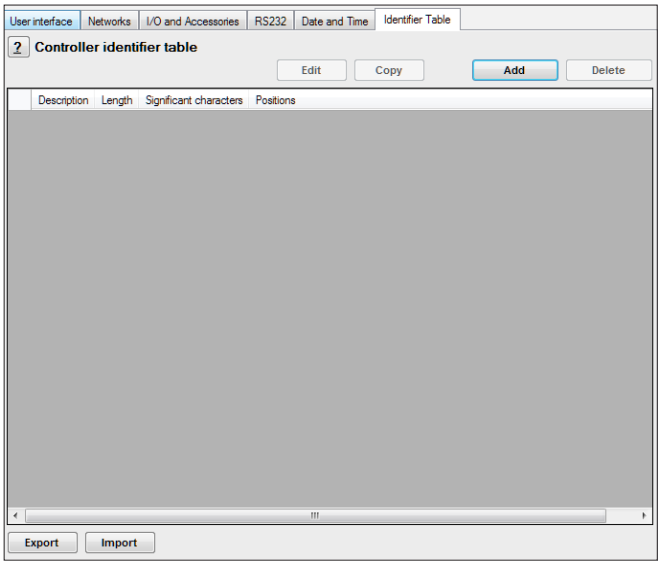
- Select the "Source of the time synchro" to synchronize with CVIPC.
- Save and quit by pressing the Save icon.

10.6 - Identifier table

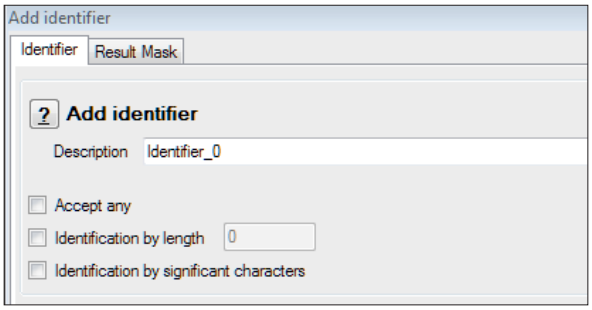
It is possible to use identifiers to start a process, to trace parts.

10.6.1 - Add/Edit an identifier

- Click on "Identifier table" to display the following screen:

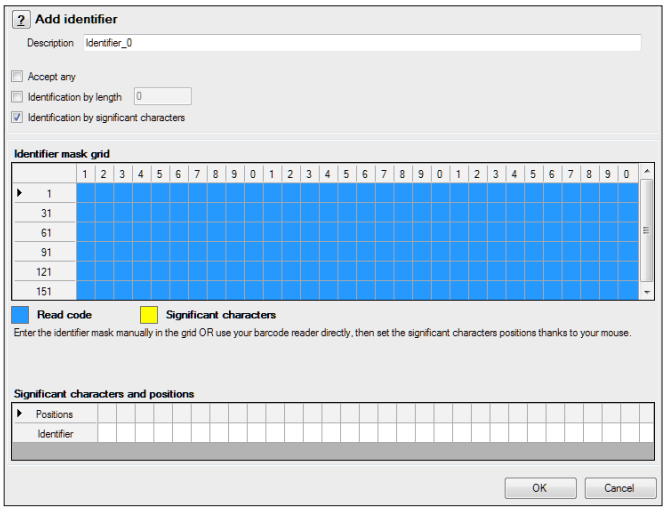


- Click on "Add" to add an identifier.



- Describe the identifier (up to 40 characters)
- Select one of the following:

Accept any	Any length or content is allowed.
Identification by length	The identifier must fulfil a specified length.
Identification by significant characters	Significant characters must be found in the received identifier. The user has to enter the significant characters into the grid.



Note that 2 different codes with the same length will have the same action.

You can copy or delete any identifier.

Import/export

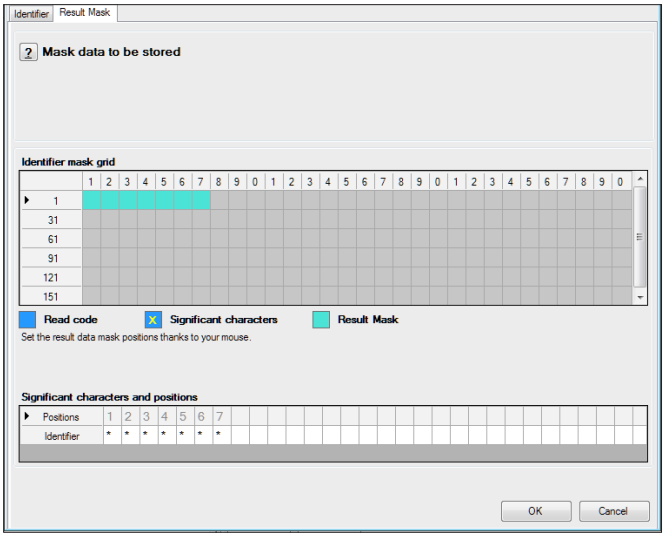
- Click on "Import" to get identifiers from an Excel file.

10.6.2 - Result mask

The result mask gives the position of the characters to be stored in the result.

Note that 2 different codes with the same significant characters at the same place will have the same action.

- Click on "Edit" and then on "Result mask" to set the significant characters positions.



- In the identifier mask grid, enter the mask manually by clicking into the boxes.
- Use this mask to set the results data positions.

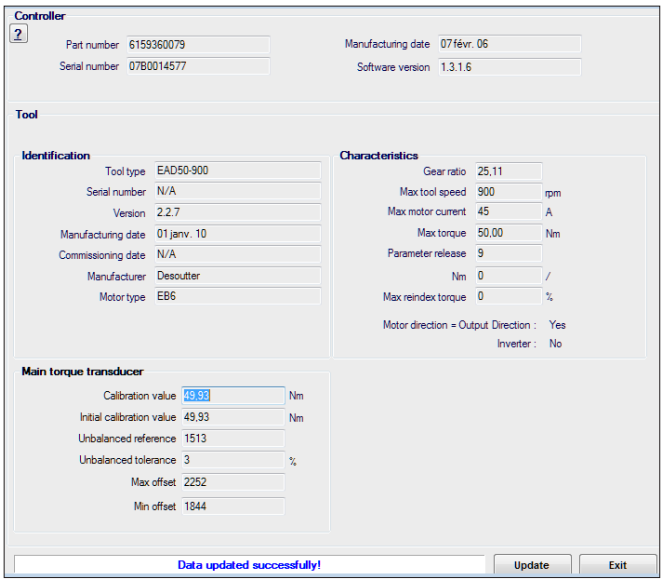
It is possible to memorise up 30 characters of a code with a result. By default, the 30 first characters are selected.

The next screen helps you to define the mask of the data to be stored.

- Note that it is possible to select several package of characters within the code.
- Save and quit by pressing the Save icon.

11 - CONTROLLER AND TOOL INFORMATION

Select one Single-tool and click on that icon to get information about the controller and the tool.



11.1 - Controller

Available information about the controller are:

Part number	manufacturer information
Serial number	
Manufacturing date	
Software version	

11.2 - Tool

Available information are:

Identification	
Tool type	manufacturer information
Serial number	
Version	
Manufacturing date	
Commissioning date	This date is automatically recorded after 2,000 tightening Psets. It is used to initialise the warranty period.
Manufacturer	manufacturer information
Motor type	
Characteristics	
Gear ratio	manufacturer information
Max. tool speed	
Max. motor current	
Max. torque	
Parameter release	
Max reindex torque	
Motor direction = output direction	yes/no
Inverter	yes/no

Main torque transducer	
Calibration value	manufacturer information
Initial calibration value	
Unbalance reference	
Unbalance tolerance	
Max. offset	
Min. offset	

The characteristics of the second torque transducer are displayed if the tool is equipped with and if the second torque transducer is enabled.

- Click on "Update" to display the current parameters. This function is useful to refresh the information, for example if you have hot swapped the tool.

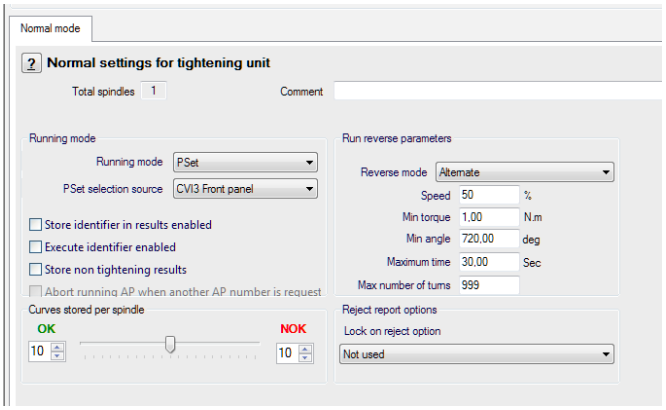
12 - TIGHTENING UNIT CONFIGURATION

This screen will allow you to adjust the settings of each spindle:

- the "Running mode"
- the "Run reverse parameters"
- the number of curves declared as OK or NOK
- the "Reject report options"
- the tool accessories and triggers

- Click on "Single-tool" and then expand the tree by clicking on the "+" on the left.

	Click on the "Tightening Unit" icon.



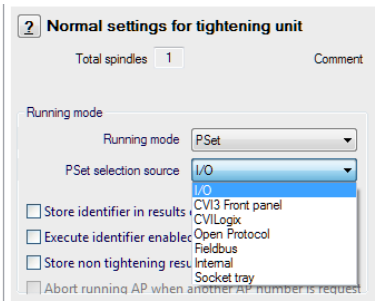
- Change the description of the tightening unit if required (up to 40 characters)

12.1 - Running mode

- Select the Running mode according to your assembly configuration:

Pset	The tool will run accordingly to the selected Pset.
Assembly Process	The tool will run according to the selected Assembly Process.

- Select the Pset selection source:



- Tick "Store identifier in results enabled" to ensure traceability e.g. to save the operator ID at the beginning of a shift.

It is possible to store up to 4 different identifiers in the same result.

- Tick "Execute identifier enabled" to trigger an action linked to the reception of an identifier.
- Tick "Store non tightening results" to record and display results other than tightening results such as loosening results, batch increment results.

12.2 - Curves distribution per spindle

- Select your own curve distribution by sliding the cursor. The maximum number of curves is 20.

12.3 - Run reverse parameters

- Select the "Reverse mode" to reverse the tool direction before starting.

Reverse once	Pushing the reverse button, the reverse direction is selected; the tool starts in reverse direction when the operator presses the trigger. Once the tool has run, the tightening direction is automatically re-activated.
Alternate	The tool runs in the selected direction when the operator presses the trigger as long as the direction does not change.
Reverse disabled	The reverse direction is not possible.

- Fill in the following values:

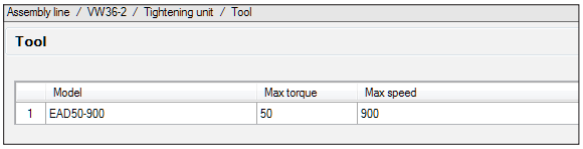
Speed	This can be used for any loosening operation (except for a Pset loosening step).
Min. torque and Min. Angle	These will allow to detect a real loosening of the assembly.
Maximum time	Maximum loosening duration
Max. number of turns	Maximum loosening turns from trigger start.

12.4 - Reject report options

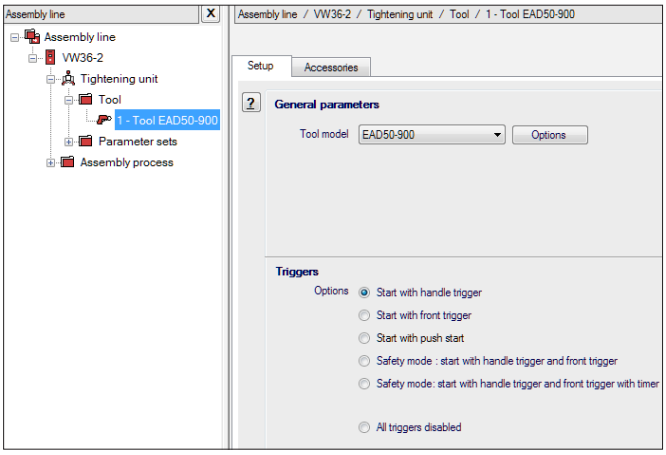
- Select one of the options to lock the tool after a NOK tightening. The tool can then be unlocked by actuating the "Error Acknowledge" input, by pushing the run reverse button or by loosening.

12.5 - Tool accessories and triggers

- Click on "Tool" to display the model, the max torque and the max speed.



- Click on the tool model to select the tool accessories and the triggers.



- Save and quit by pressing the Save icon.

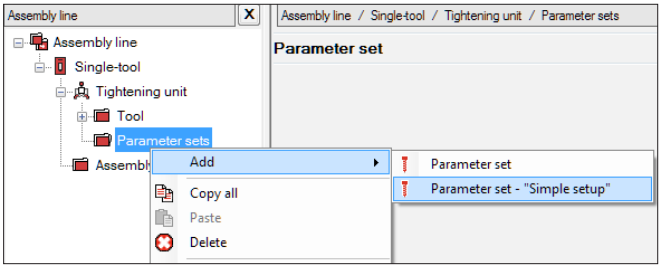
13 - PARAMETER SET PROGRAMMING

This chapter will teach you to:

- create a Pset within 3 steps.
- adjust the parameters to refine the tightening sequence.
- set up the curves display.
- copy/paste and delete Psets.

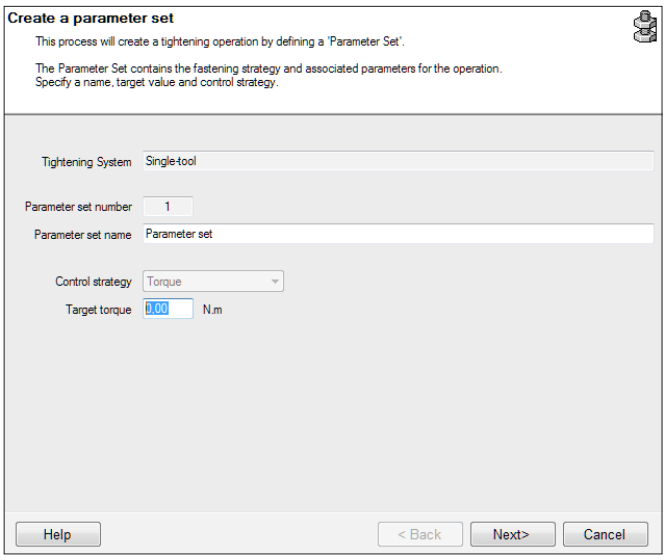
13.1 - How to create a Pset

- Select a Tightening Unit and click on "Parameter set".
- Click the right mouse button to display the following screen:



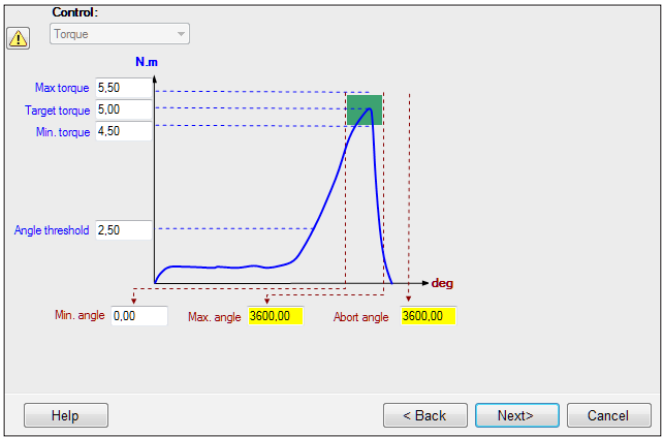
- Select "Simple Setup" and let you guide by the software. The tightening operation will be done within 3 steps. The tightening strategy is "Torque control with angle monitoring" by default.

1st step : enter the "Target torque"



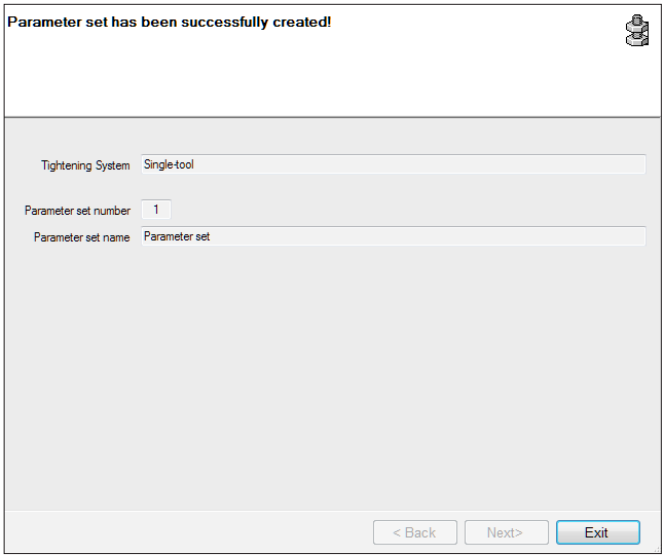
- Click on "Next".

2nd step: enter the monitoring angle values.



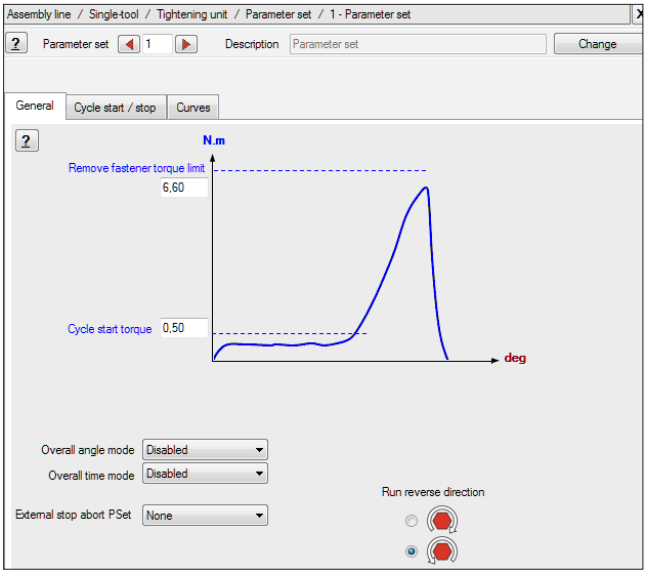
- Fill in the values and Click on "Next".

Last step.



- Click on "Exit" to finish.

The following screen is displayed:



Now you can adjust the parameters if required to refine the tightening operation.

13.2 - Pset general parameters

13.2.1 - Cycle start torque

The "Cycle start torque" is the torque value that must be reached to declare the Pset as started. Below this value, no result will be generated.

13.2.2 - Remove torque fastener limit

The remove fastener torque limit is the torque limit above which the fastener (bolt and screw) may have suffered damage and must be replaced. By default, the value is set to 120% of the target torque. This torque value may lie above the maximum tool torque.

13.2.3 - Overall angle mode

The overall angle can be measured during the complete tightening operation, i.e. starting at the overall angle threshold and until the end. This option excludes an "Overall time mode".

- Disabled: the overall angle is not measured.
- Monitoring: the overall angle is simply measured.
- Control: if the overall angle gets out of limits, the result of the tightening operation is NOK, the tool stops.

13.2.4 - Overall time mode

The overall time can be measured during the complete tightening operation, i.e. starting at the overall time threshold and until the end. This option excludes an "Overall angle mode".

- Disabled: the overall time is not measured.
- Monitoring: the overall time is simply measured.

13.2.5 - External stop abort Pset

- Select one of the following:
- on rising edge
- on falling edge
- on change
- on high level
- on low level

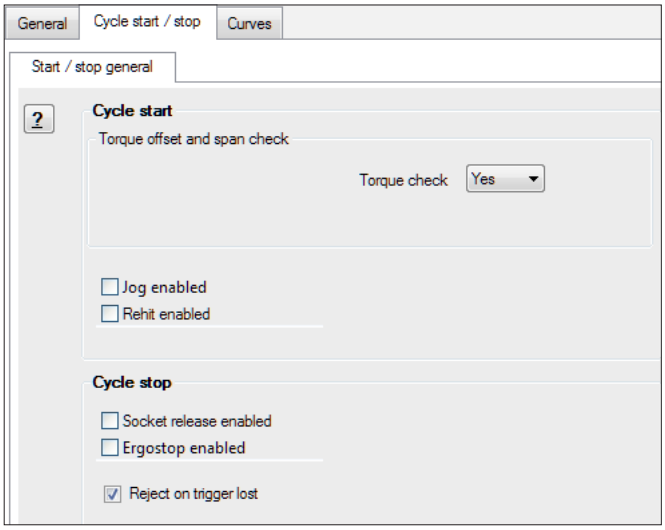
13.2.6 - Run reverse direction

- Select if:
- clockwise
- counterclockwise

- Click on "Save" to quit.

13.3 - Cycle start

- Click on "Cycle start/stop" to display the following screen:

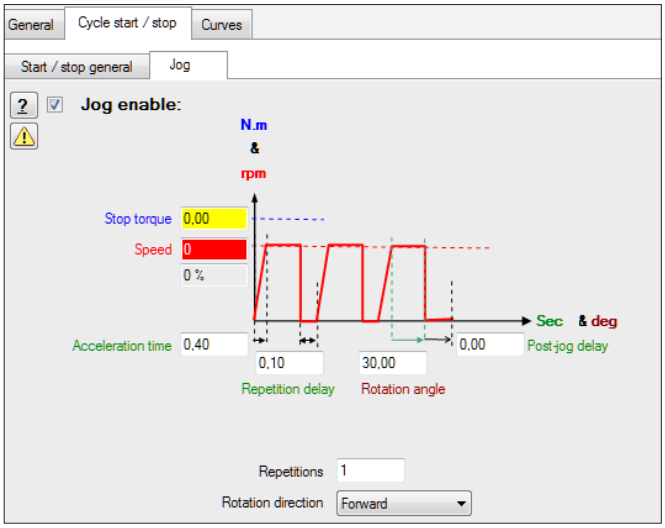


13.3.1 - Torque check

If yes, the torque offset value will be checked at each Pset start and a span test will be performed.It is recommended to set this parameter to "Yes" to detect the torque offset and to span the drift.

13.3.2 - Jog enabled

The jog function helps to fit the tool socket onto a bolt. When enabled, a spindle turns a given "rotation angle" in a specific direction (forward, reverse or alternate) and repeatedly (n times). The jog function can be selected for each spindle.



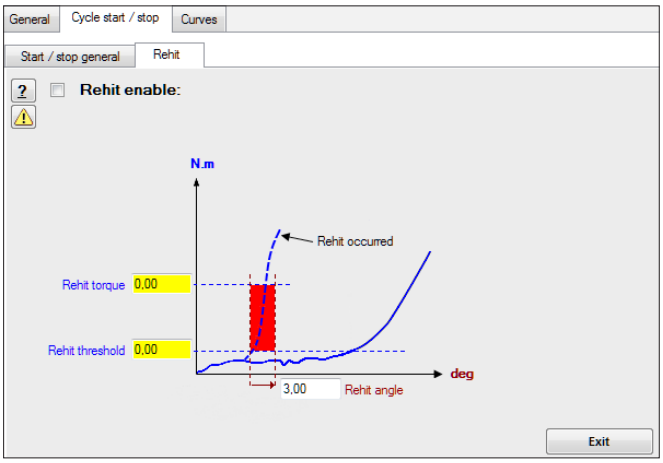
- Fill in the screen:
- stop torque
- speed
- acceleration time
- repetition delay
- rotation angle

- post-jog delay
- repetitions
- rotation direction

• When finished, tick the box on the top left to valid your selection and click on "Exit" to quit.

13.3.3 - Rehit enabled

This function is used to detect that a joint has been re-tightened.
The conditions for rehit are: Rehit enabled AND Angle reached between "Rehit threshold" and "Rehit torque" < "Rehit angle".



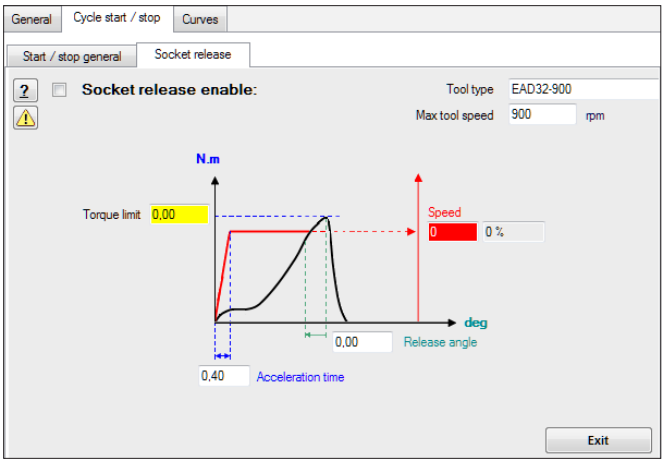
• Fill in the screen:
- rehit torque
- rehit threshold
- rehit angle

• When finished, tick the box on the top left to valid your selection and click on "Exit" to quit.

13.4 - Cycle stop

13.4.1 - Socket release enabled

This is used to release the constraint between the socket and the screw. When relaxation is enabled, the tool rotates in reverse a few degrees in order to easily remove the socket.



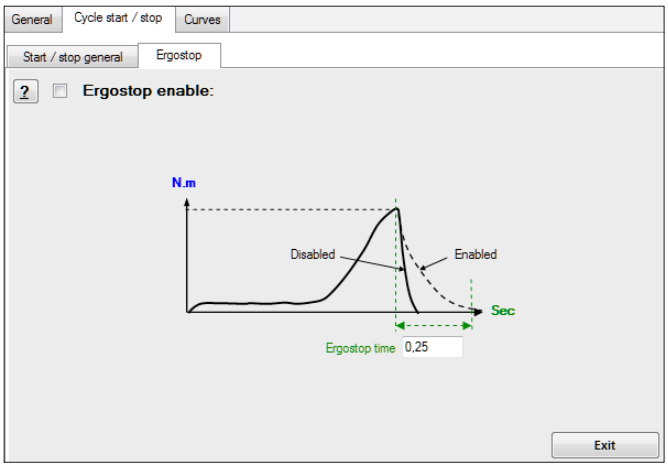
• Fill in the screen:

- torque limit
- acceleration time
- speed in % of the tool max speed.

• When finished, tick the box on the top left to valid your selection and click on "Exit" to quit.

13.4.2 - Ergostop enabled

This options allows for a smoother tool stop so as to reduce torque reaction on the operator.



• Fill in the screen:
- Ergostop time: min. 0.25 s

• When finished, tick the box on the top left to valid your selection and click on "Save" to exit.

13.4.3 - Reject on trigger lost

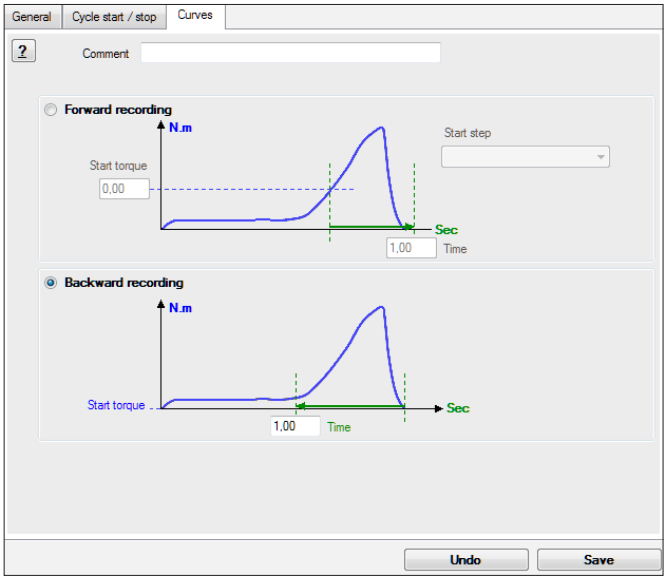
• Tick this option: yes/no.

The Pset will be rejected if the start signal is released before the end of the tightening operation. If this option is not checked, the result is reported on the calculation of trends.

• Save and quit by pressing the Save icon.

13.5 - Setting up the curves display

This chapter will allow you to set the curves as they will appear when uploading curves from the controllers.



• Enter a comment to customize your selection (up to 100 characters).

13.5.1 - Forward recording

The torque and angle values are saved from the start torque till the end of the tightening during a set time.

- Enter the "Start torque"
  If set to 0, the curve is recorded starting at the end of the tightening operation.
- Enter the "Time":
  Curve recording time. A curve has a maximum of 2,000 points.
- "Start step": enter the step number from where the curve recording begins.

13.5.2 - Backward recording

The curve is recorded from the "start torque" to the end of the tightening and rewinds for a set time.

- Enter the "Time". A curve has a maximum of 2,000 points.
- Save and quit by pressing the Save icon.

13.6 - How to add/copy/paste/delete a Pset

- In the Build area, click on "Parameter set", then use the right click of the mouse to add a new Pset.
- To copy/paste or delete a Pset, select first the relevant Pset and use the tools in the Buid area.

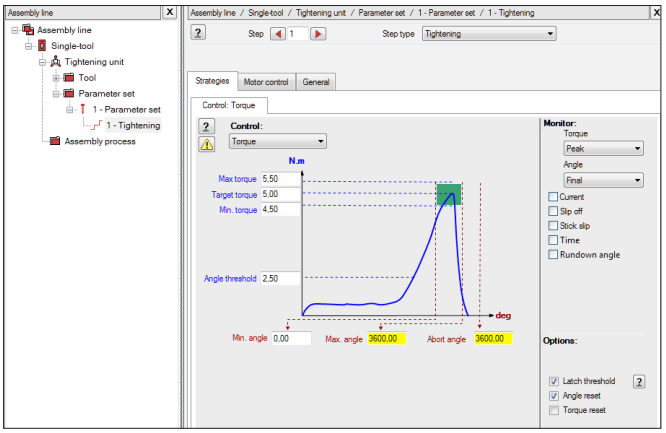
14 - STEP PROGRAMMING

This chapter will teach you to:

- create your own tightening strategies
- set up the motor controls
- adjust the parameters to refine your work.

14.1 - How to create a step

- Click on "Parameter set" and expand the tree.
- Click on "1- Tightening" to display the following screen:

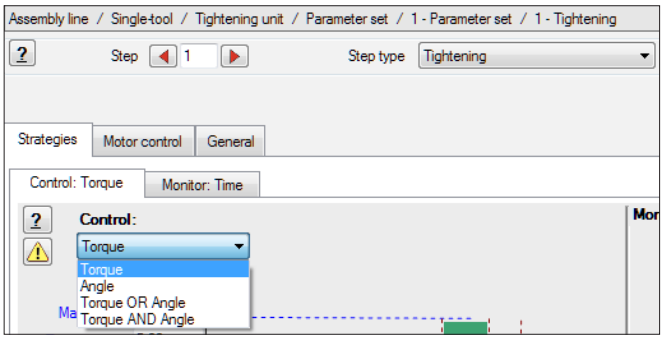


You are now ready to select the tightening strategy, the motor control and the general parameters.

14.2 - Step type selection

Refer to "Appendix - Tightening strategies" to get more information about the strategies.

14.2.1 - Tightening

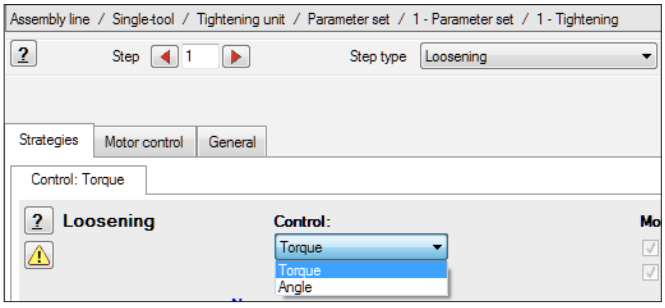


- First select "Tightening" in the Step type box.
- Select the type of Control in the Control box:

- Torque
- Angle
- Torque OR angle
- Torque AND angle

- Fill in the values according to your selection.

14.2.2 - Loosening

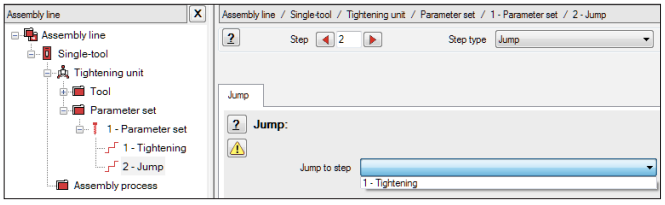


- Select "Loosening" in the Step type box.
- Select the type of Control in the Control box:

- Torque
- Angle

- Fill in the values according to your selection.

14.2.3 - Jump



- Select "Jump" in the Step type box.
- Select the step number to jump to.

14.3 - Monitor

- Select the monitoring strategy and tick the box to open the corresponding screen.

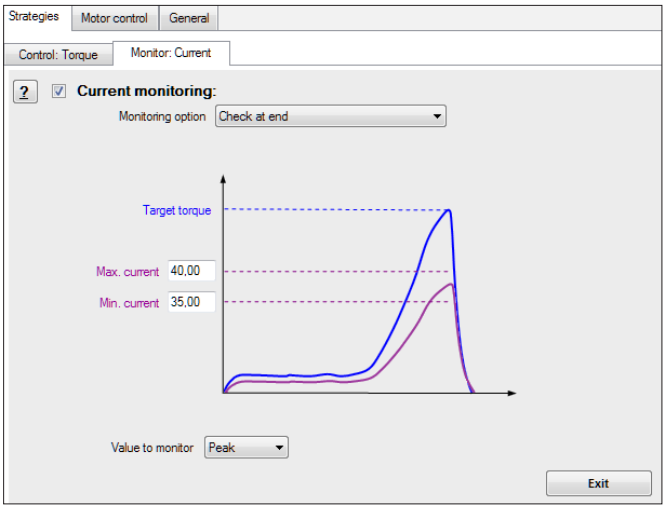
Refer to "Appendix - Tightening strategies" to get more information about the monitoring strategies.

14.3.1 - Peak or Final Torque/Angle

For all control strategies, torque and angle are systematically monitored.

For torque and angle monitoring, it is possible to choose either the peak value or the final value to be monitored. Generally, the peak value is used for the torque and the final value for the angle.

14.3.2 - Current/Check at end

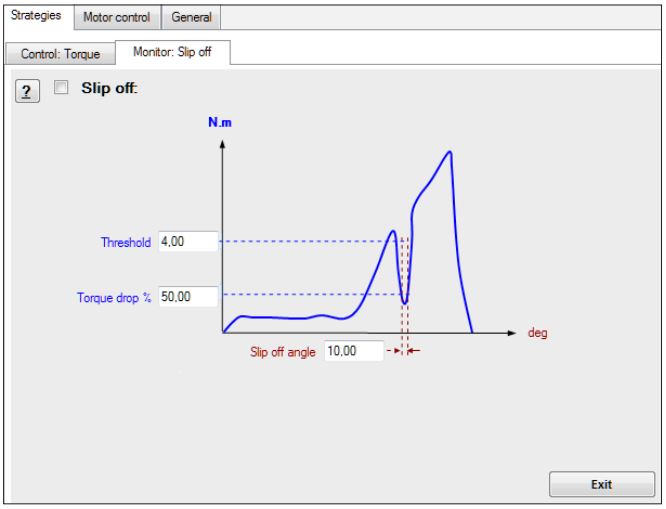


The "Current/check at end" checks the torque value measured by the torque transducer and the current drawn by the motor for coherence. It is a simple way to detect any torque drift or any drift of efficiency in the tool.

The monitored value can be "Peak" or "Final".

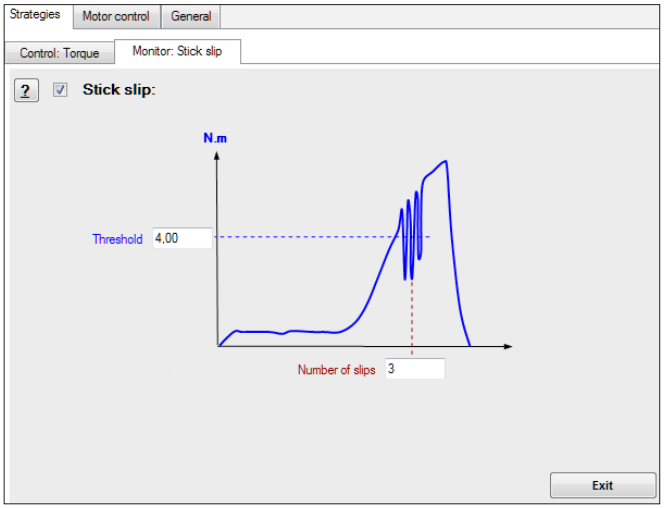
- Fill in the values according to your selection.
- Tick the box on the top left to confirm your selection and click on "Exit" to quit the screen.

14.3.3 - Slip off



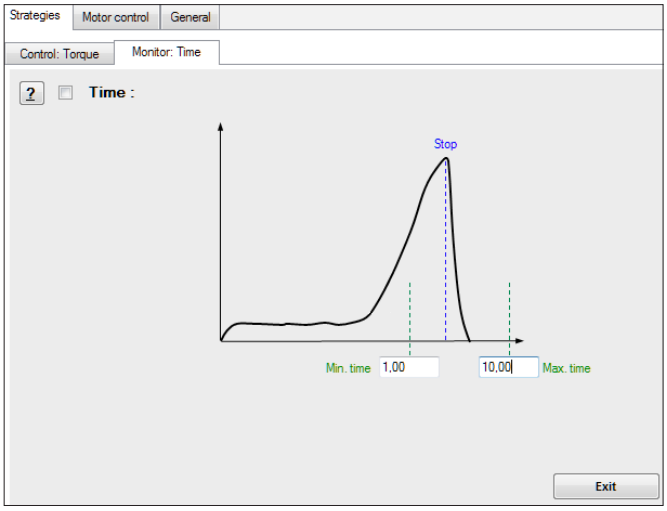
- Fill in the values.
- Tick the box on the top left to confirm your selection and click on "Exit" to quit the screen.

14.3.4 - Stick slip



- Fill in the values.
- Tick the box on the top left to confirm your selection and click on "Exit" to quit the screen.

14.3.5 - Time

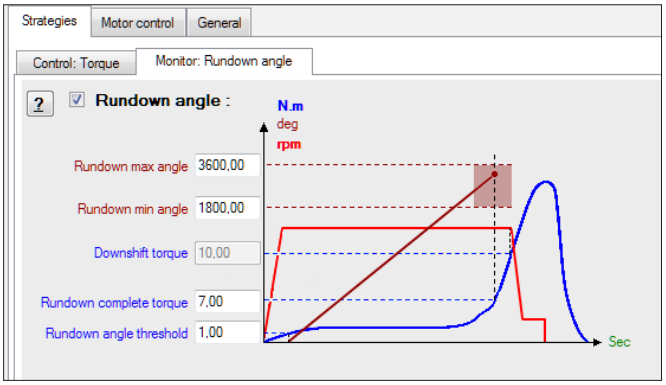


- Fill in the values.

A step duration can last from 0 to 99.9 sec.

- Tick the box on the top left to confirm your selection and click on "Exit" to quit the screen.

14.3.6 - Rundown angle



- Fill in the values.
- Tick the box on the top left to confirm your selection and click on "Exit" to quit the screen.

14.4 - Options

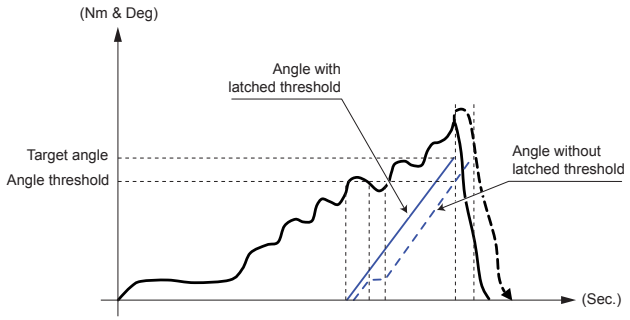
Refer to "Appendix - Tightening strategies" to get more information about the options.

14.4.1 - Latch threshold

When this option is ticked, the controller starts measuring the angle when the torque crosses the angle threshold for the first time. The measure then continues till the end even if the torque becomes below the threshold. The measured angle is therefore closed to the real angle. The angle is measured starting at a torque value called "Angle threshold".

There are 2 possibilities:

- Without latched threshold: the controller stops counting the angle when the torque falls below Angle threshold.
- With latched threshold: the controller starts counting the angle as soon as the torque rises above the Angle threshold. If the torque should fall below Angle threshold, the controller proceeds counting.



14.4.2 - Angle reset

- Tick this option to reset the angle measurement at the beginning of each step. This is generally the case. However, e.g. for multi steps applications, it may be useful not to reset the angle measured during the previous step.

14.4.3 - Torque reset

- Tick "Torque Reset" to reset the torque measurement at the beginning of each step. This is generally the case. However, e.g. for multi steps applications, it may be useful not to reset the torque measured during the previous step.

14.5 - Motor control

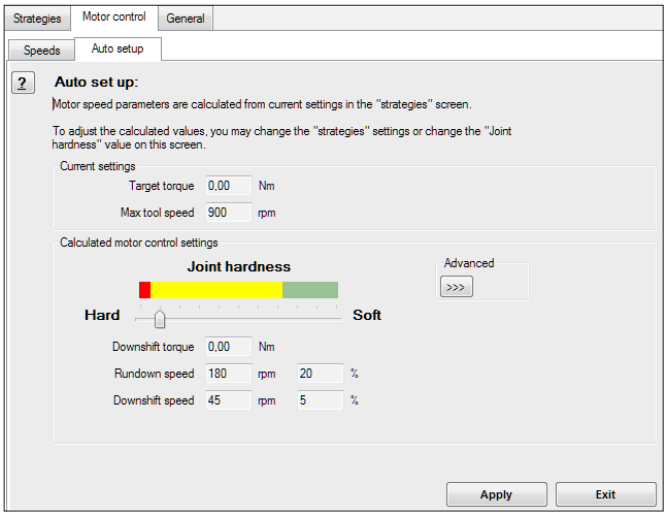
Refer to "Appendix - Tightening strategies" to get more information about the motor controls.

14.5.1 - Auto set up

In case you are not familiar with speed settings, we recommend you to let you guide by the software.

The motor control parameters are calculated by using the inputs from the "Strategies" settings:

- Click on "Auto set up"



- Move the cursor to get the best adjustment until you can click on "Apply". The "Downshift torque" value will fit accordingly.
- Click on "Advanced" to select the degrees from 50 to 100% of target torque.
- Click on "Apply" to valid your selection.

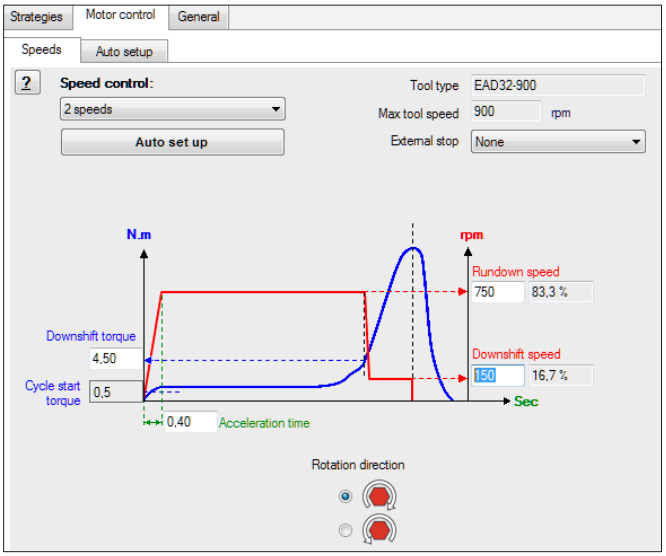
14.5.2 - Speed settings

- In case you are familiar with speed settings, click on "Speeds".

There are 2 possibilities:

- 2 speed
- 3 speed - ergospeed

2 speed

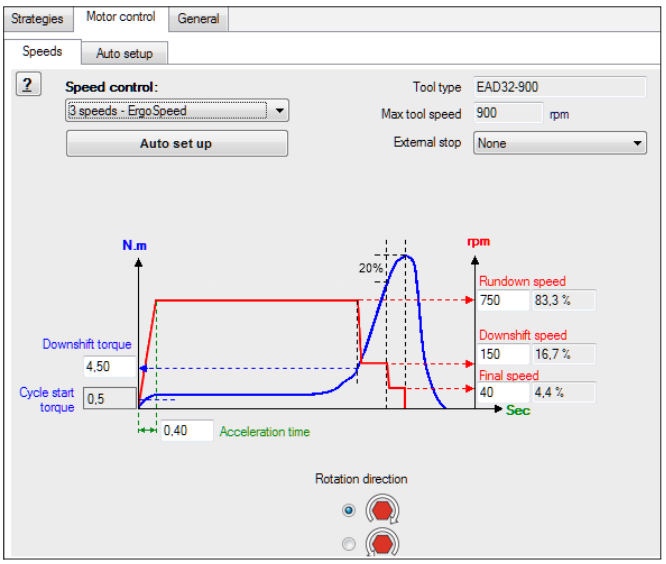


2-speed motor control is the most popular and the simplest to use. It runs high speed up the downshift torque and finishes the tightening operation at lower speed.

- Fill in the values.
- Select the Rotation direction: Clockwise/Counterclockwise.
- Select "External stop" to stop the current phase and shifts to the next one as soon as one of the following signals shifts to “1”:

- on rising edge:
- on falling edge:
- on change:
- on high level:
- on low level:

3 speed - ergospeed



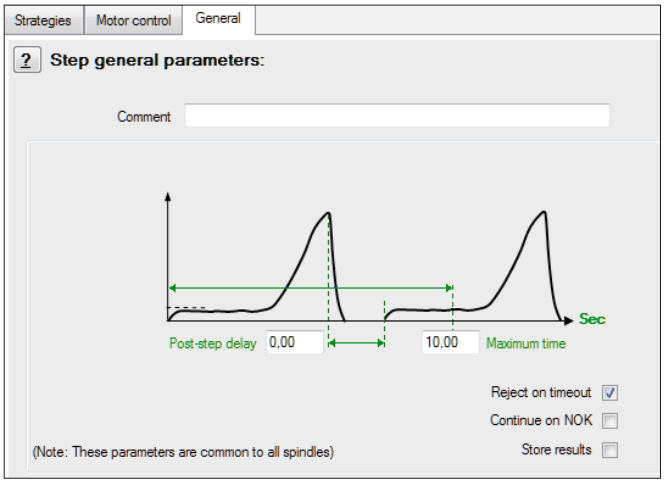
3-speed - ergospeed motor control is a good compromise between Pset time and accuracy and it improves the operator comfort.

- Fill in the values.
- Select the Rotation direction: Clockwise/Counterclockwise.
- Select "External stop" to stop the current phase and shifts to the next one as soon as one of the following signals shifts to “1”:

- on rising edge
- on falling edge
- on change
- on high level
- on low level

14.6 - General parameters

- Click on "General" to display the following screen:



The step general parameters are common to all spindles.

- Add a comment (up to 100 characters).
- Fill in the values.

Post step delay

This is the time between 2 steps.

Max. time

This is the maximum step duration before proceeding to the next one (10 s by default)

Reject on timeout

- Tick the box to declare the phase NOK in case of a step timeout. If not, the result is measured against the setpoints of tightening.

Continue on NOK

- Tick the box to continue the tightening even if the step result is NOK.
  This function is not activated on the last step.

Store results

- Tick the box to record the step in the tightening results.
- Save and quit by pressing the Save icon.

14.7 - How to add/copy/paste/delete a step

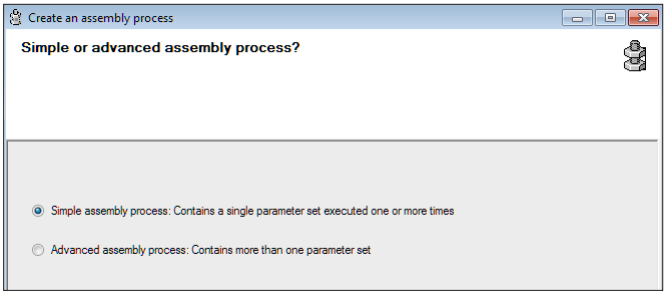
- In the Build area, click on "Step", then select the step type for the new step.
- To copy/paste or delete a step, select first the step and use the tools in the Buid area.

15 - ASSEMBLY PROCESS PROGRAMMING

CVIPC will guide you to create a new Assembly Process.

- Click on "Assembly Process" in the Build area.
- Select "Simple" or Advanced"

15.1 - Simple Assembly Process



- Click on "Next".
- Customize the description (up to 40 characters)
- Select the source:

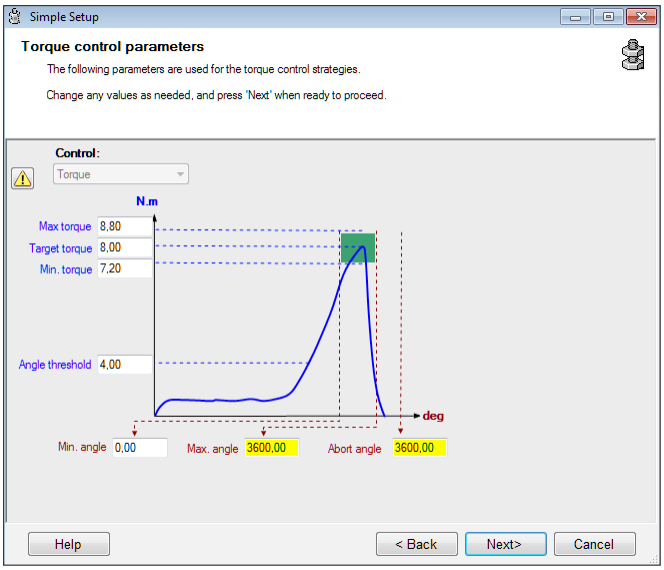
- I/O
- HMI
- Open Protocol
- Fieldbus

- Enter the batch size: 1-99.

If you select a new Pset:

- Enter the Pset name (up to 40 characters)
- Select the "Control strategy"
- Enter the "Target torque"
- Click on "Next".

The following screen is displayed:



- Fill in the values and click on "Next".

A new Pset has been successfully created

- Click on "Exit"again to finish the process.

A new Assembly Process has been successfully created

- Click on "Exit".

If you select an existing Pset:

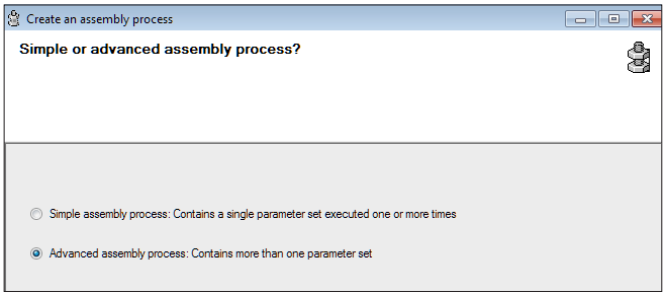
The process is shorter because the Pset parameters are already defined.

- Select the existing Pset
- Click on "Next" to finish the process.

A new "Assembly Process" has been successfully created.

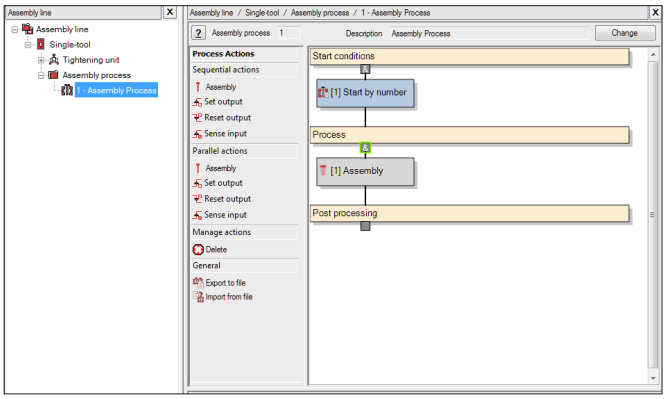
- Click on "Exit".

15.2 - Advanced Assembly Process



- Click on "Next".
- Select the Assembly Process number
- Validate by pressing OK

The following screen is displayed:

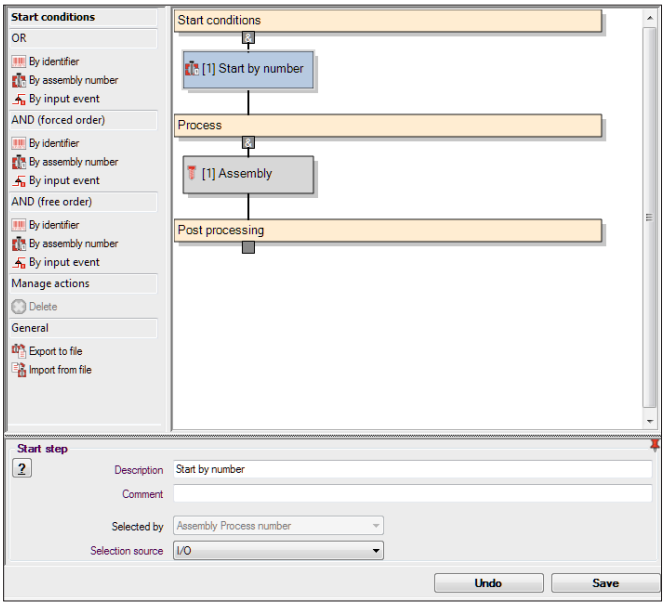


To enlarge the display of work, remove the "Build" area by unticking it in the View menu.

15.3 - Start conditions

There are 3 types of starting actions:

start by number	This is the Assembly Process number. It can be selected by the controller HMI, by an I/O (selector box), by Fieldbus or Open Protocol.
start by identifier	E.g. a barcode. This implies that you have already set up an identifier in CVIPC. Refer to chapter "Identifier table" to create an identifier.
start by input event	This implies that you must pick an input event and assign it to a physical output.



15.3.1 - Logical operators

You can add up to 7 parallel or sequential actions linked by one of the following logical operators:

OR	The process starts if 1 or the other condition is fulfilled. For example: backup mode handling. The Assembly Process normally starts by an identifier. If the identifier is not readable, the backup starts by number select source I/O.
AND (forced order)	The process starts if all conditions are fulfilled in the correct order. For example: VIN number then part number are scanned to start the process.
AND (free order)	The process starts if all conditions are fulfilled whatever the order. For example: the operator has to scan VIN and part number but the order is not forced.

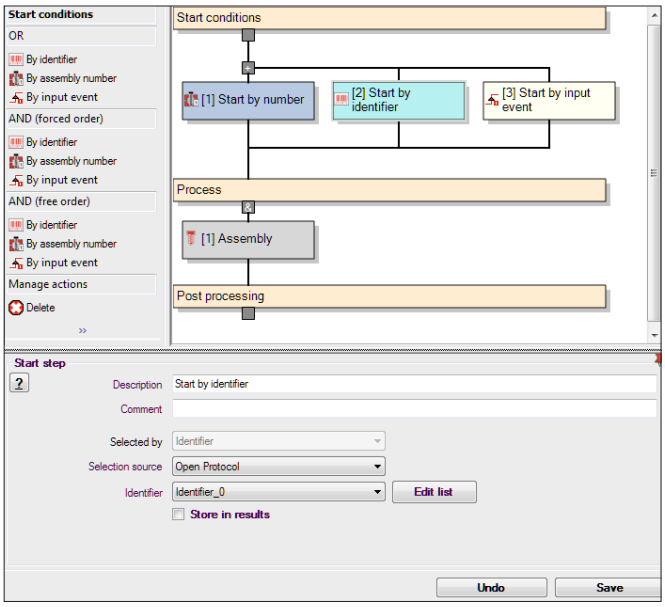
- Save and quit by pressing the Save icon.

15.3.2 - Start by number

- Click on "Start by number". This first condition is compulsory and it is not possible to delete it.
- Slide the mouse on the bottom screen to display the "Start step" parameters.
- Customize the "Start step" description (up to 40 characters)
- Enter a comment (up to 100 characters).
- Select the source:
- I/O
- HMI
- Open Protocol
- Fieldbus

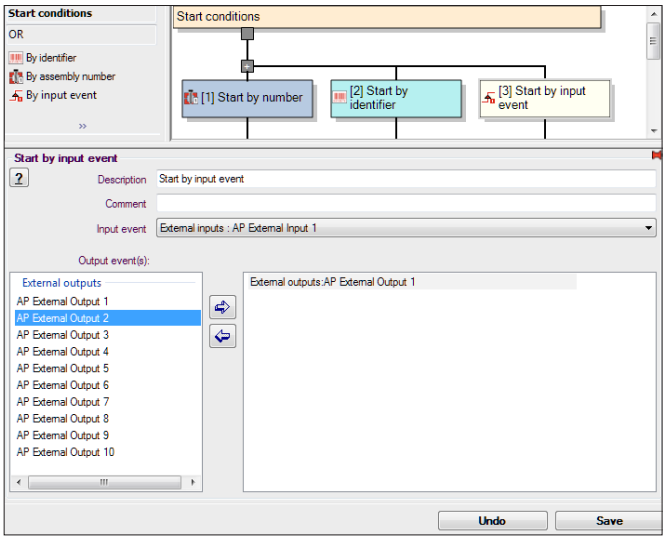
	Click this icon to dock the bottom screen.
	Click this icon to undock the bottom screen.
	Click this icon to delete an action

15.3.3 - Start by identifier



- Enter a description (up to 40 characters) and a comment (up to 100 characters).
- Choose the "Selection source".
- In the "Identifier" box, select the required identifier name. Click on "Edit list" to view all identifiers and modify them if necessary.
- Tick on "Store in results" to to ensure traceability e.g. to save the operator ID at the beginning of a shift.
- Save and quit by pressing the Save icon.

15.3.4 - Start by input event



- Enter a description (up to 40 characters)
- Enter a comment (up to 100 characters)
- Select an "Input event"
- Click below on one of the output events to select it or click on "External outputs" to select them all.
- Use the arrows to add them on the right or remove them on the left.
- Save and quit by pressing the Save icon.

15.4 - Process actions

There are 4 types of Process actions:

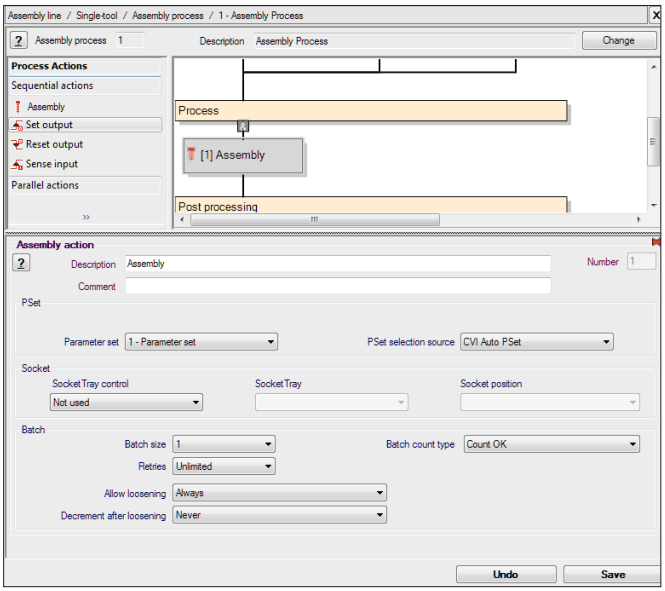
Assembly	The assembly action is associated to a Pset to run an assembly operation.
Set output	During the assembly process, the controller triggers an "AP external output bit 0-9" output event. This event can be linked to a 24 V output.
Reset output	During the Assembly Process, the controller resets an "AP external output bit 0-9" output event This event can be linked to a 24 V output.
Sense input	This input waits for the rising edge of a specific input.

Process actions can be sequential or parallel. The logic operators are AND and OR.

	Click this icon to dock the bottom screen.
	Click this icon to undock the bottom screen.
	Click this icon to delete an action

15.4.1 - Assembly action

- Click on "Assembly" to start building the tree of Process actions. This first action is compulsory and it is not possible to delete it.
- Slide the mouse on the bottom screen to display the parameters.



- Enter a description (up to 40 characters)
- Enter a comment (up to 100 characters). This comment is displayed on the controller.

Pset

You have to select the Pset which will control the tightening operation.

- Select one of the Psets already programmed.

Pset selection source

- Select the source which is allowed to select the Pset or the current Pset by selecting "CVI Auto Pset".

Socket

Socket tray control	
not used	The tightening operation is allowed.
lift	The Assembly Process is expecting the operator lifts the socket.
put all back and lift	The Assembly Process is expecting the operator lifts the socket. In case the socket is already lifted, the operator has to put it back and lift it again.
Socket tray	
[0] IO socket tray	CVI II socket tray on the I/O.
[1-F] IO socket tray	[1-F] is the address number of the CVI3 socket tray on the eBUS. Note that the address is unique per accessory.
Socket position	
from 1 to 32 according to the socket tray model.	

Batch

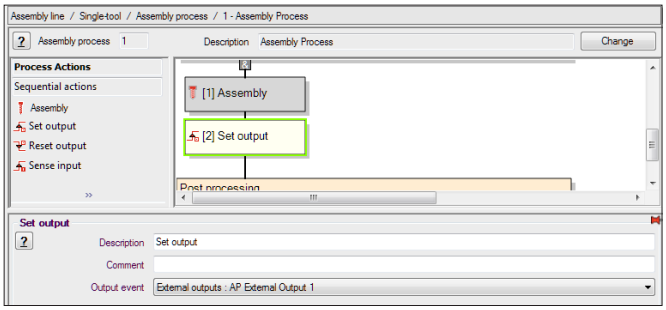
- Enter the batch size: 1-99
- Select the number of retries: 1-99/unlimited.
  The last Pset will be re-executed according to the selection.
- Select the batch count type:
- count OK cycles only
- count all cycles:

If you want to decrement the batch counter after a loosening operation, select "Always" or "After OK". If not, select "Never".

If you want to allow the joint loosening, select "Always" or "After NOK". If not, select "Never".

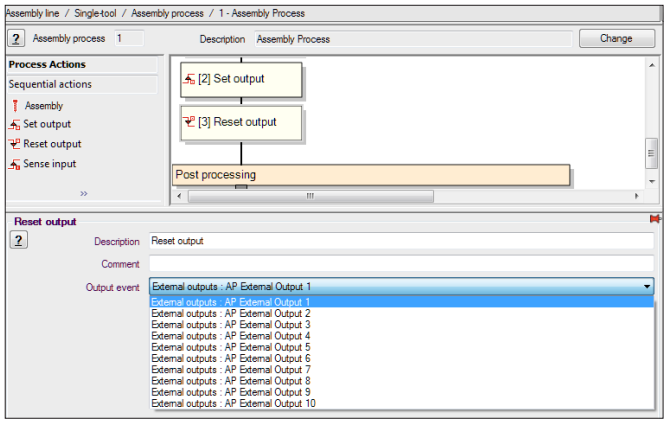
- Click on "Save".

15.4.2 - Set output action



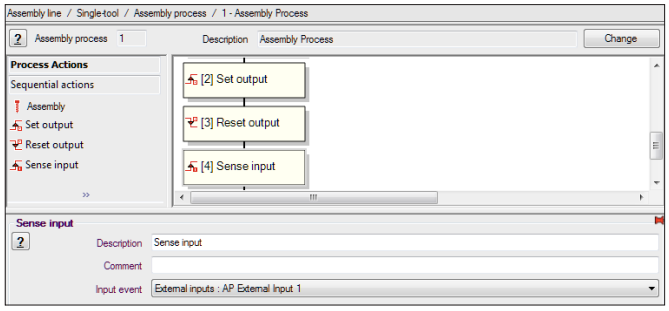
- Enter a description (up to 40 characters)
- Enter a comment (up to 100 characters)
- Select an "Output event" among the AP external outputs (bit 0-9).

15.4.3 - Reset output action



- Enter a description (up to 40 characters)
- Enter a comment (up to 100 characters)
- Select an "Output event" among the AP external outputs (bit 0-9).

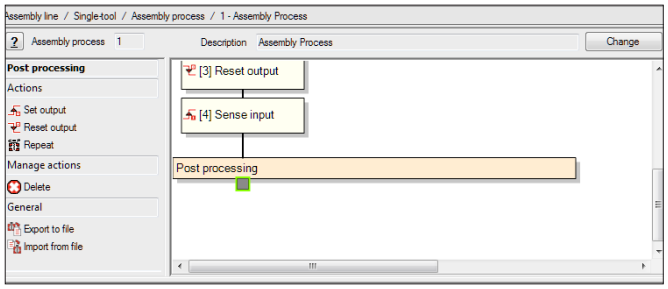
15.4.4 - Sense input action



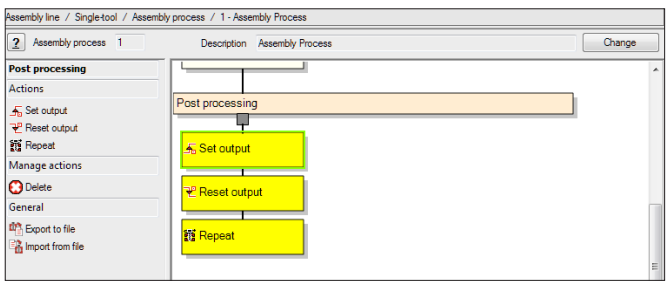
- Enter a description (up to 40 characters)
- Enter a comment (up to 100 characters)
- Select an "Input event" among the AP external inputs (bit 0-9).

15.5 - Post processing

Process actions can be sequential or parallel. The logic operators are AND and OR.



- Click on the grey square located under Post processing to display the available actions.



There are 3 possible actions:

Set output	At the end of the process, the CVI3 triggers an output event AP external output bit 0-9, this event can be linked to a 24 V output
Reset output	At the end of the process, the CVI3 reset an output event AP external output bit 0-9, this event can be linked to a 24 V output
Repeat	When enabled, this function will allow starting the AP again without waiting the source start. When disabled, a source start information is required to start this AP or another one.

	Click this icon to delete an action

- Click on "Save".

15.6 - Assembly Process import/export

- Click on "Export to file" to save the Assembly Process in a file named "Assembly Process.AP.xml" and located in the following path: C:\Program Files\Desoutter\CVIPC.
- Click on "Import to file" to import a file named "Assembly Process.AP.xml" from the following path: C:\Program Files\ Desoutter\CVIPC.
- Change the file location as you like.

16 - PC TO CONTROLLER DATA TRANSFER

The transfer depends on how the PC is connected to the controller(s).

The PC can be connected to the controller(s) via a "Point to point" OR a network connection.

In a "Point to point communication" mode, data are transferred to the controller in real-time. You can start running the Assembly Process at once.

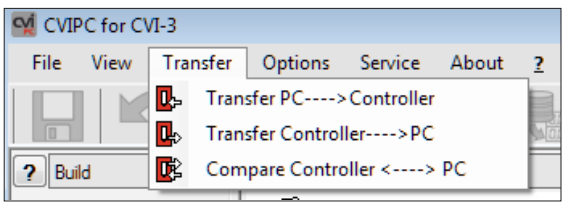
In a "Network communication" mode, you will have to transfer data from the PC to the connected controllers, one by one.

In both modes, ensure that the "Running mode" in the controller(s) is correctly set (Pset or Assembly Process). Refer to the controller's user manual to know how to set the controller.

- To transfer data, use the Transfer menu or the tool bar.

16.1 - Transfer menu

- In the main menu, click on "Transfer":



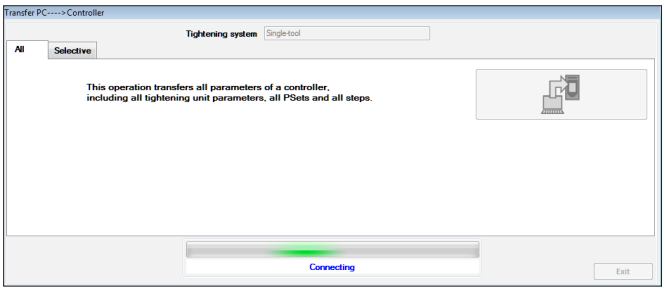
The transfer menu is active only when a single-tool is selected.

- Select the transfer direction.

You can also compare PC data with controller data and then decide to upload data.

- Click on "All" to transfer all parameters including Psets and Assembly processes.

An alternative is to transfer part of the data: click on "Selective" tab and select the data to be transferred as shown below.



16.2 - Tool bar

- Before transferring data from the PC, you need to identify the controller where to send the data by clicking on it.

	Use this icon to transfer data from the PC to the controller.

17 - RESULTS

17.1 - How to get the last results/curves

- Select a "Tightening unit" and click the following icon:

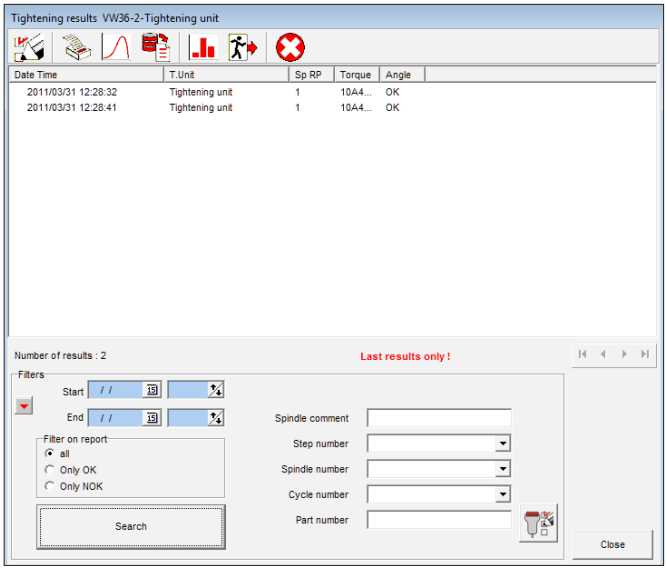
CVIPC will automatically get the last results from the controller and the "Viewercvipc" application will be launched.

CVIPC will automatically get the last curves from the controller and the "Viewercvipc" application will be launched.

17.2 - Viewercvipc application

This new icon will appear on your computer.

This application allows you to view and analyse the results that you have uploaded.



17.2.1 - Results display

Click this icon to customize the display of results.

- Tick the elements to display and move the cursor to the right or left to view them all.
- Valid by pressing OK.

17.2.2 - Results filtering

- Use the filter boxes to sort the results by date, by type of report or by item number.
- Click the red arrow
- Press the "Search" button to start the process.

You can also filter the results by:

- spindle comment
- step number
- spindle number
- cycle number
- part number

17.2.3 - Barcode reader connection

Click this icon to set up the connection with the barcode reader and fill in the screen.

17.2.4 - Printing results

Click this icon to print the results

17.2.5 - Curves display

Click this icon to view the curves.

17.2.6 - Exporting files

Click this icon to export data to a text file.

17.2.7 - Statistics computing

Click this icon to start computing statistics

Refer to "APPENDIX - Statistic computation" to get more information about the Statistics computation.

18 - MAINTENANCE

18.1 - CVIMONITOR software

Desoutter has developped a specific software to monitor results, maintenance and diagnostic data in real-time.

In details, CVIMONITOR offers:

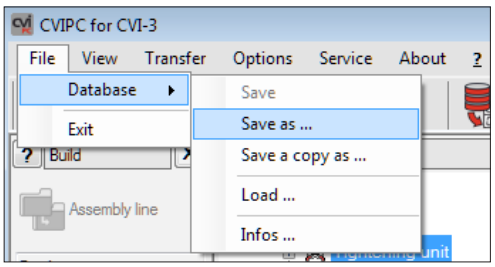
- Real-time process monitoring with results, curves &
- statistics
- Real-time maintenance monitoring with I/O status, counters
- (controller, tool, cable)
- Trouble-shooting with alarms history (logs), problem solving
- guidance.
- User information history

Select a controller and click this icon to launch the CVIMONITOR software.

- Refer to the CVIMONITOR's user manual supplied on the CDROM.

18.2 - Database back-up

- Click on "File" in the Menu area.



Sub-menu	Action
Save	to save your work in the database.
Save as	to save your work in the database. Use an unique name. The path is by default: C:\Program Files\ Desoutter\CVIPC.
Save a copy as	to copy an existing database and rename it.
Load	to upload an existing database.
Infos	to display the database file location.

Be careful when naming the databases. Do not overwrite them. We recommend to create as many folders as assembly lines.

1 - INTRODUCTION

1.1 - Step type selection

Select a STEP TYPE	
Assembly step	**Management step**
Tightening	Jump
Loosening	

1.1.1 - Tightening

Tightening is the main function of the CVI3.

1.1.2 - Loosening

The loosening function allows un-tightening the joint according specific events:

- The tightening operation is made on another station. The present station first loosens the joint a little bit and retightens it to the final targets (to condition a joint).
- Un-tightening after a rejected tightening operation.
- Un-tighten clamps used to maintain parts while machining.

1.1.3 - Jump

The jump function can be used to execute endurance tests, rework.

1.2 - Control and Monitor types

A control type defines the way to stop the step.
A monitoring type defines the way to get the result of the step.

Control	Monitor					
	Torque (mandatory)	Angle (mandatory)	Current - Check at end	Slip off or Stick slip	Time	Rundown angle
Torque	✓	✓	✓	✓	✓	✓
Angle	✓	✓	✓	✓	✓	✓
Torque OR angle	✓	✓	✓	✓	✓	✓
Torque AND angle	✓	✓	✓	✓	✓	✓

1.3 - Options

Latch angle threshold	When there are a lot of ripples on the torque progress, it might happen that the controller starts measuring the angle and stops for short times because the torque becomes below the angle threshold. The result is that the measured angle is below the real angle. Using the latched threshold option, the controller starts measuring the angle when the torque crosses the angle threshold for the first time. The measure then continues until the end, even if the torque becomes below the threshold. The measured angle is therefore closed to the real angle. The angle is measured starting at a torque value called "Angle threshold".
Angle reset	When this option is selected, the angle measurement is reset at the beginning of each step. This is generally the case. However, e.g. for multi step applications, it may be useful not to reset the angle measured during the previous step.
Torque reset	When this option is selected, the torque measurement is reset at the beginning of each step.

1.4 - Motor control

Auto-speed	This type of control is appropriate for simple tightening steps with high joint variance (mix of hard, medium, soft joints or one joint with variable behaviour). It automatically & dynamically adapts the tool speed and power within each step to optimize process capability, cycle time and ergonomics for that particular step.
2-speed	This type of control is the most popular and easiest to use for simple to advanced tightening steps with low joint variance. It runs high speed up to the downshift torque and finishes the tightening operation at lower speed to optimize process capability, cycle time and ergonomics for that particular step..
3-speed	This type of control is appropriate and easiest to use for simple to advanced tightening steps with hard to very hard joints. It runs high speed up to the downshift torque, then slow down in 2nd shift to break inertia and finishes the tightening operation at lower speed to optimize process capability, cycle time and ergonomics for that particular step.
Auto setup	This type of control is the easiest to start tightening for beginners. There is no speed or power parameter to set. The user defines joint type (from hard to soft) or joint angle (in degrees) and the system automatically defines rundown & final speed (based on a 2-speed step type).

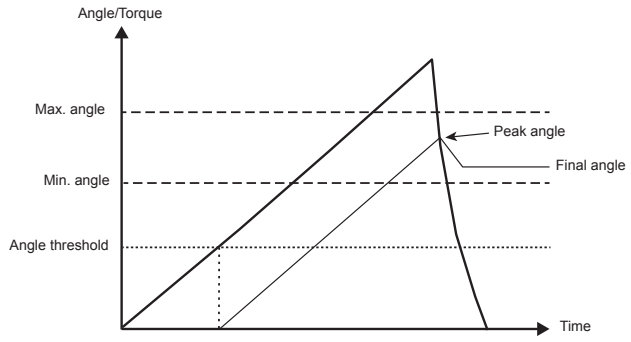
2 - MAIN PARAMETERS

2.1 - Control

Target torque	The step is stopped when this torque value is reached
Abort angle	The step is aborted if this angle value is reached

2.2 - Monitor

Max torque	torque value which defines the max torque limit
Min torque	torque value which defined the min torque limit
Max angle	angle value which defines the max angle limit
Min angle	torque value which defines the min angle limit
Angle threshold	torque threshold value to start counting angle (usually 50% of target torque)
Peak or Final torque	For all control strategies, torque and angle are systematically monitored. Generally, the peak value is used for the torque and the final value for the angle.
Peak or Final angle	



2.3 - Start conditions

The Pset starts as soon as the "Pset start" signal is active AND the "Pset start torque" is reached (if set to a value different from 0).

- Torque is measured from the "Pset start torque".
- Angle is measured from the angle threshold.

2.4 - General advice

The start of the angle threshold counting should lie within the linear area of the torque increase.

We recommend to adjust the angle threshold in order to get the final angle around 60° or 80°.

In case of an angle control strategy, the angle threshold must be as low as possible to minimise the uncertainty on the tension at the angle threshold value.

3 - CVI3 CONTROLLERS LEDS COLOR CODE

LED color	Designation	Action
Green	Accept report	-
Yellow	Incomplete rundown	Tighten again
Orange	Reject report	Loosen and tighten again
Red	Above High Angle	Remove and replace fastener.

4 - TIGHTENING

4.1 - Torque control

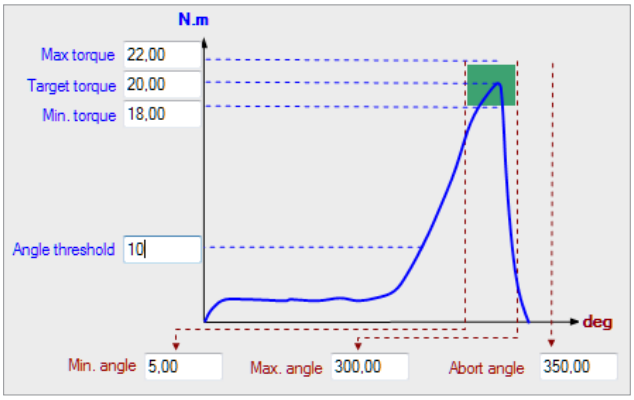
A torque control strategy coupled with an angle monitoring is adapted for most assemblies.
It offers:
- the insurance that the tightening operation is correctly done
- a regular joint quality.

To reach this performance, the angle is monitored to detect joint issues, i.e. "cross threads", missing washer, broken bolt, different lengths of bolts, rehit.

Example of usage:

Safety critical joints without particular requirements on the tension accuracy, where angle monitoring is recommended:
- Wheel assembly, rear and front wheel hub assembly connections, car body to sub-frame assembly, seat-belt.

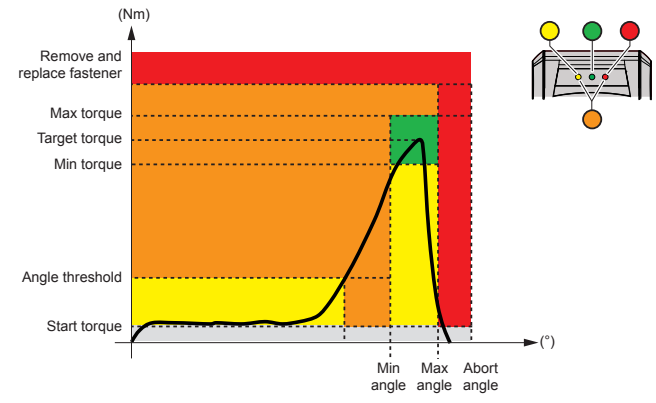
Quality critical to standard joints:
- Car body components, instrument panels, accessories, engine assembly, gear box assembly.



Stop conditions
IF Torque ≥ Target torque OR Angle > Abort angle

Report OK	IF Min torque < Peak or Final Torque < Max torque AND IF Min angle < Peak or Final Angle < Max angle

For each channel, the 3 report controller LEDs will light according to the following diagram:



Result data	Peak OR Final torque Peak OR Final angle

4.2 - Angle control

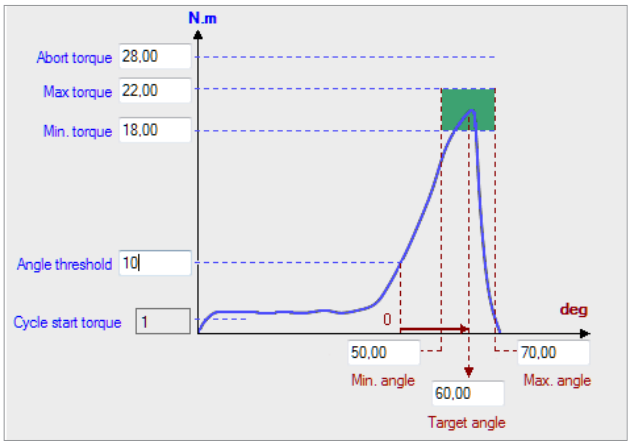
A tightening angle control strategy is adapted for assemblies requiring tension accuracy.

It offers:
- the insurance that the tightening operation is correctly done
- a regular joint quality
- accurate & repeatable tension inside the joint.

This strategy provides a better control of the tension and a better repeatability and accuracy than the torque control strategy.

Example of usage:

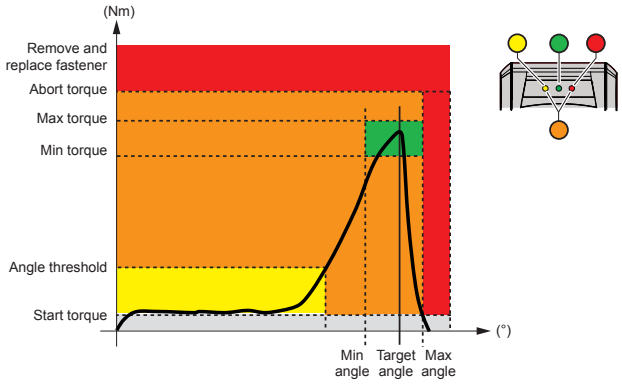
Safety critical components and high reliability internal engine parts
- Connecting rods and engine main bearings, Fly wheel, Engine cylinder-head, Break calipers, Steering components



Stop conditions
IF Angle ≥ Target angle OR IF Torque ≥ Abort torque

Report OK	IF Min torque < Peak or Final Torque < Max torque AND IF Min angle < Peak or Final Angle < Max angle

For each channel, the 3 report controller LEDs will light according to the following diagram:



Result data	Peak OR Final torque Peak OR Final angle

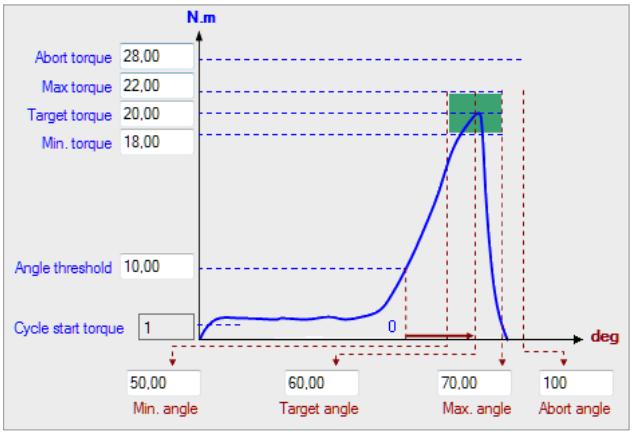
4.3 - Torque AND angle control

The tightening torque AND angle control strategy is adapted for assemblies requiring tension accuracy.

It offers:

- the insurance that the tightening operation is correctly done
- a regular joint quality
- a better control of the tension
- a better repeatability
- a better accuracy

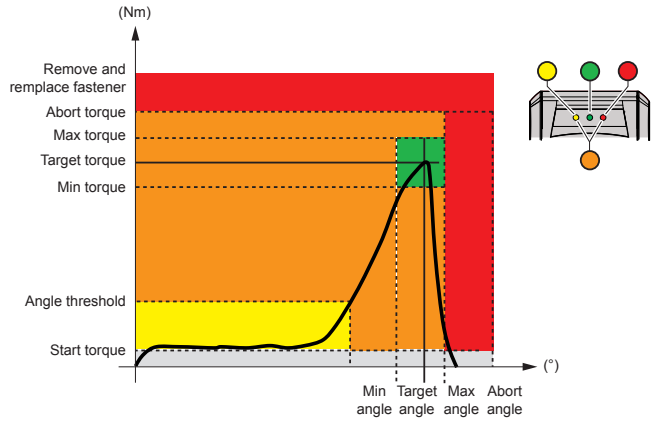
An angle control: the tool stops when both torque AND angle reach their target values.



Stop conditions
IF Torque ≥ Target torque AND Angle ≥ Target angle OR IF Torque ≥ Abort torque OR IF Angle ≥ Abort angle

Report OK	IF Min torque < Peak or Final Torque < Max torque AND IF Min angle < Peak or Final Angle < Max angle

For each channel, the 3 report controller LEDs will light according to the following diagram:



Result data	Peak OR Final torque Peak OR Final angle

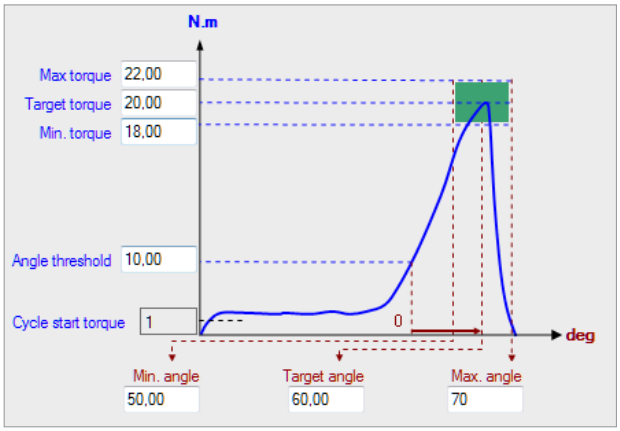
4.4 - Torque OR angle control

The tightening torque OR angle control strategy is adapted for assemblies requiring tension accuracy.

It offers:

- the insurance that the tightening operation is correctly done
- a regular joint quality
- a better control of the tension
- a better repeatability
- a better accuracy

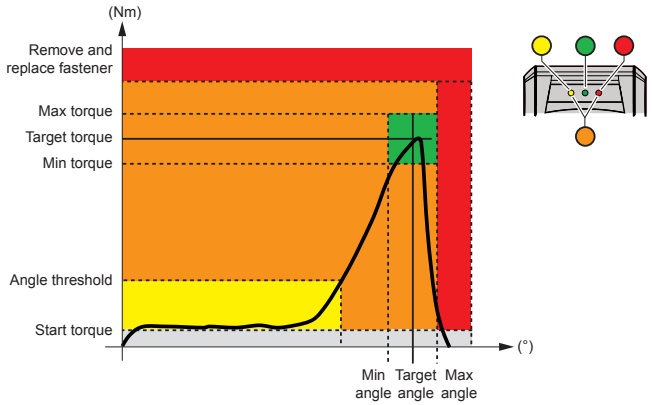
An angle control: the tool stops when either the torque OR the angle reaches its target value.



Stop conditions
IF Torque ≥ Target torque OR IF Angle ≥ Target angle

Report OK	IF Min torque < Peak or Final Torque < Max torque AND IF Min angle < Peak or Final Angle < Max angle

For each channel, the 3 report controller LEDs will light according to the following diagram:



Result data	Peak OR Final torque Peak OR Final angle

5 - LOOSENING

The loosening function allows un-tightening the joint according specific events:

The tightening operation is made on another station. The present station first loosens the joint a little bit and retightens it to the final conditions

Un-tightening after a rejected tightening operation.

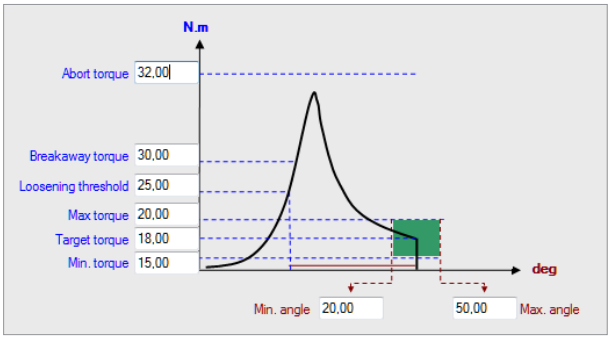
Un-tighten clamps used to maintain parts while machining…

The possible loosening strategies for the loosening control are: Torque control / Angle control.

5.1 - Torque control and angle monitoring

Loosening with torque control and angle monitoring is used when you want to keep up a small constraint in the assembly.

The un-tightening operation is not complete.

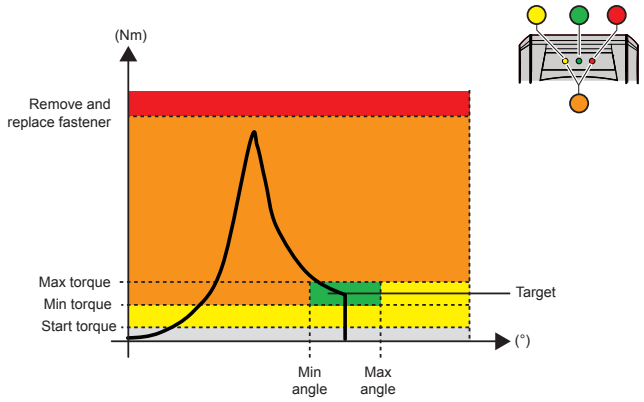


Parameters

Breakaway torque	starts the torque measure.
Loosening threshold	starts the angle measure.

Report OK	IF Min torque < Final torque < Max torque AND IF Min angle < Peak or Final Angle < Max angle.

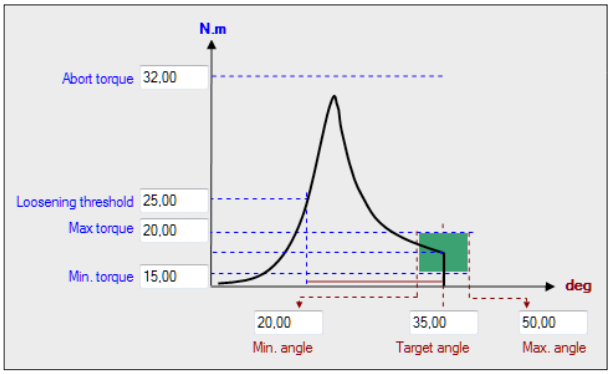
For each channel, the 3 report controller LEDs will light according to the following diagram:



Result data	Final torque Peak OR Final angle

5.2 - Angle control and torque monitoring

Loosening with angle control is mainly used to release the constraints in the assembly completely. When this strategy is selected, the torque and the angle are monitored automatically.



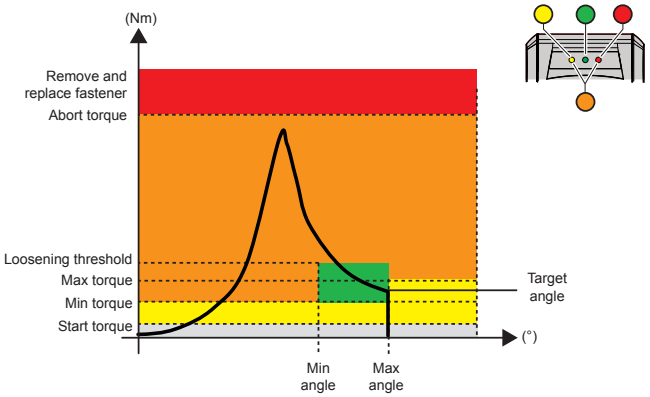
Parameters

Loosening threshold	Start the angle measure.
Target angle	Loosening angle expected.

Stop conditions
IF Angle ≥ Target angle OR IF Torque ≥ Abort torque.

Report OK	IF Min torque < Final torque < Max torque AND IF Min angle < Angle < Max angle

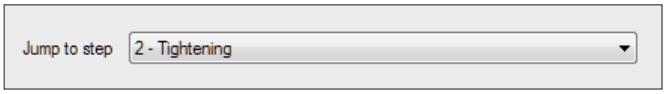
For each channel, the 3 report controller LEDs will light according to the following diagram:



Result data	Final torque Peak OR Final angle

6 - JUMP

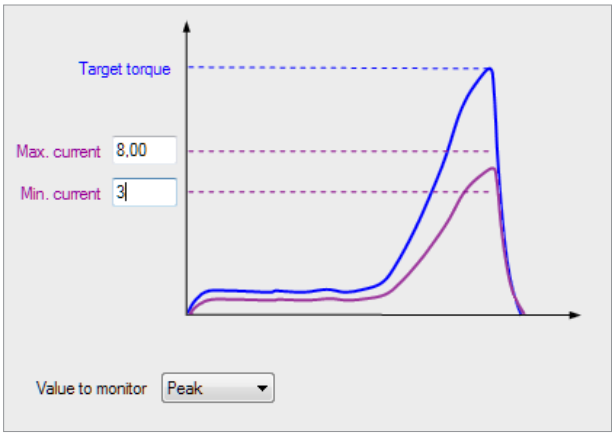
This step allows continuing a Pset by jumping to another step within the same Pset.



7 - CURRENT - CHECK AT END

Adding a current monitoring makes the fastening operation even more reliable, it acts as a "second torque transducer monitoring". Even if transducerised tools provide high reliability, as the level of production is very high, they still need to be checked regularly. The current monitoring is a way to both reduce the checking and detect pro-actively potential maintenance issues.

The current - check at end monitoring checks the torque value measured by the torque transducer and the current drawn by the motor for coherence. It is a simple way to detect any torque drift or any drift of efficiency in the tool.



Parameters

- Max current.
- Min current.

Value to monitor: Peak OR Final current.

The "Current" information varies from one tool to another and is not calibrated against the torque. It is therefore necessary to establish a similarity on an experimental basis for each tool:

- First read the value of the maximum current reached at the end of a Pset.
- Then execute the Pset at least 3 times to define the "minimum current" and "maximum current" values.
- Enter these values.

Report OK	IF Min current < Current < Max current.

For each channel, the 3 report controller LEDs will light as follows:

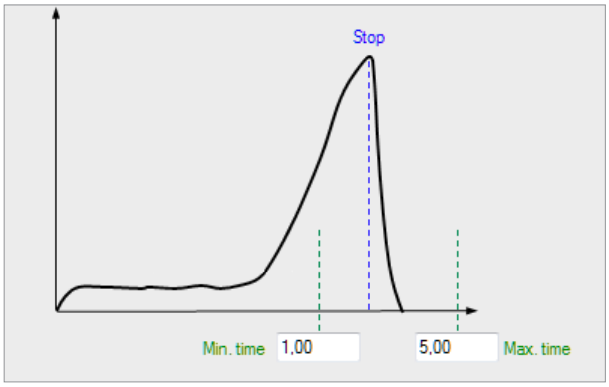
LED			Designation
1	2	3	
			Max current monitoring, Angle < Max angle AND Torque < Remove fastener limit
			Max current monitoring, Angle > Max angle OR Torque > Remove fastener limit
			Min current monitoring, Angle < Max angle AND Torque < Remove fastener limit
			Min current monitoring, Angle > Max angle OR Torque > Remove fastener limit

Result data	Peak OR Final current

8 - TIME

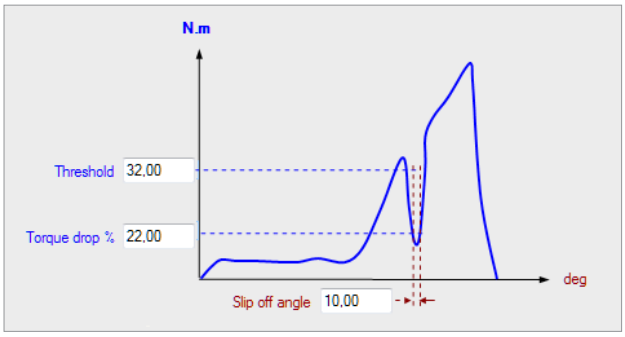
The Time monitoring is made to frame the tightening operation duration.

Example of usage: to differentiate different screw lengths.



9 - SLIP OFF

Associated to a tightening step, the Slip off monitoring is made to detect abnormal torque drops during the torque progress.



Parameters

Threshold	starts the angle measure.
Torque drop %.	% of torque drop from the threshold within the slip off.
Slip off angle	angle window where the torque drop % is measured.

The torque decrease during a certain angle is monitored.

The angle is measured from the moment the torque reaches the slip off monitoring threshold.

When the slip off is detected, the torque drops by x % below the torque threshold within the slip off angle.

Stop conditions
IF slip off detected

Report OK	IF no slip off detected.

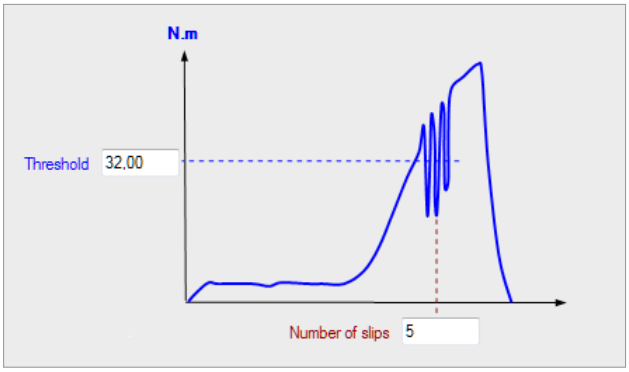
For each channel, the 3 report controller LEDs will light as follows:

LED			Designation
1	2	3	
			Slip off detected, Angle < Max angle AND Torque < Remove fastener limit
			Slip off detected, Angle > Max angle OR Torque > Remove fastener limit

Result data	IF slip off detected.

10 - STICK SLIP

Associated to a tightening step, the Stick slip monitoring is made to detect abnormal series of torque drops / vibrations during the torque progress.



Parameters

Threshold	torque from where the number of slips starts to be measured.
Number of slips	number of times where the torque goes over and under the threshold.

Stick slip is detected if the torque does not succeed in exceeding the stick slip monitoring threshold without going over and under this threshold N times.

Stop conditions
Stick slip detected

Report OK	No stick slip detected.

For each channel, the 3 report controller LEDs will light as follows:

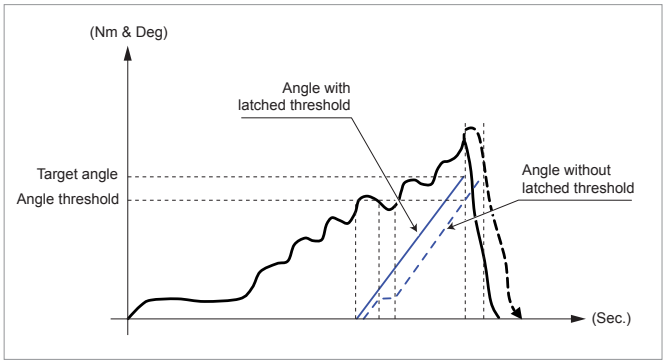
LED			Designation
1	2	3	
			Stick slip detected, Angle < Max angle AND Torque < Remove fastener limit
			Stick slip detected, Angle > Max angle OR Torque > Remove fastener limit

Result data	Error IF stick slip detected.

11 - LATCH ANGLE THRESHOLD

There are 2 types:

- Without latched threshold (default mode):
  The controller stops counting the angle when the torque falls below the angle threshold.
- With latched threshold:
  The controller starts counting the angle as soon as the torque rises above the angle threshold. If the torque should fall below the angle threshold, the controller proceeds counting.



12 - MOTOR CONTROL

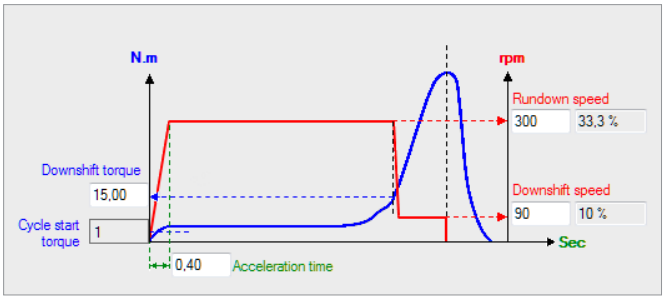
Speeds are set manually or by using the "Auto set up" function.

Speed units (rpm or % of max tool speed) are to be selected in the controller user interface. In any case, a minimum speed of 30 rpm is always recommended.

Stop conditions (for all tightening strategies)

- Timeout
- Pset start signal going down
- Hardware failure (max current, max temperature...)

12.1 - 2-speed

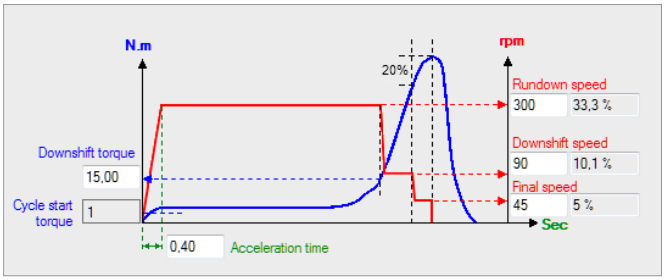


Parameters

Acceleration time	Time to increase speed from 0 to Rundown speed.
Rundown speed	Speed applied from start to downshift torque to optimize productivity
Downshift torque	Torque where speed moves from Rundown to Downshift speed.
Downshift speed	Speed applied from Downshift torque to motor stop to optimize quality.
Rotation direction	Forward / Reverse

Starting at the start signal, the spindle runs with a programmed acceleration up to Rundown speed. The spindle keeps running at Rundown speed. Once Downshift torque has been reached, the speed changes to Downshift speed.

12.2 - 3-speed



Parameters

Acceleration time	Time to increase speed from 0 to Rundown speed.
Rundown speed	Speed applied from start to downshift torque to optimize productivity
Downshift torque	Torque where speed moves from Rundown to Downshift speed.
Downshift speed	Speed applied from Downshift torque to the 2nd Downshift to break inertia or very hard joints.
Final speed	Speed applied from the 2nd Downshift (80% of Target torque) to motor stop (to optimize quality on very hard joint).
Rotation direction	Forward / Reverse

Starting at the start signal, the spindle runs with a programmed acceleration up to Rundown speed. The spindle keeps running at Rundown speed. Once Downshift torque has been reached, the speed changes to Downshift speed. Once 80% of the Target torque has been reached, the speed changes to Final speed.

1 - LIST OF STANDARDS

List of standards available for statistical calculations:

- ISO 5393 (proposed by default)
- CNOMO (E41.32.110.N)
- NF E 60-181 - Means of production - Method for assessing ability to make components
- Q544000 V6.0

2 - GLOSSARY

Measurements	Number of measurements selected for the computations.
Samples	Number of samples of 5 measurements.
Tolerance interval	Result of maximum tolerance minus minimum tolerance.
Lowest value	lowest value of the population.
Highest value	Highest value of the population.
Values < min. tol	Number of values below the minimum tolerance.
Values > max. tol	Number of values over the maximum tolerance.
Mean	Mean of population.
CAM	Process capability according CNOMO standard.
CPK	Coefficient of position and dispersion.
CP	Process capability according ISO standard.

3 - CNOMO STANDARD

Instantaneous standard deviation: σ_i

Estimated from the mean range $\overline{W}$ of the samples of 5 measurements which form the population.

$$\sigma_i = \frac{\overline{W}}{d5} \quad \text{where:} \quad \overline{W} = \frac{\sum W}{K}$$

W = Range of measurements on each sample = max. value - min. value.

K = Number of samples of 5 measurements.

$$d5 = 2.326 - \frac{1.645 \times 0.864}{\sqrt{K}}$$

coefficient for a 95% confidence threshold.

Instantaneous dispersion: $Di = 6 \times \sigma_i$

Process capability: $CAM = \frac{IT}{Di}$

where IT (Tolerance Interval) = Max. tolerance - Min. tolerance

Testing the homogeneity of the population, each sample of measurements **W** must comply with:

$$W < 0.643 \times \frac{IT}{CAM\ cdc}$$

Standard deviation:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N} (xi - \overline{X})^2}{N - 1}}$$

where:

$$\overline{X} = \frac{\sum_{i=1}^{N} xi}{N}$$ population mean.

xi population value.

N number of measurements of the population.

Corrected standard deviation:

$$\sigma_0 = C \times \sigma$$

where **C** is a function of the number of samples.

Number of samples	Coefficient C
3	1.51
4	1.41
5	1.34
6	1.28
7	1.26
8	1.24
9	1.22
10	1.21
11	1.19
12	1.18
13	1.17
14	1.17
15	1.16
16	1.15
17	1.15
18	1.14
19	1.14
20 to 22	1.13
23 to 25	1.12
26 to 31	1.11
32 to 35	1.10
36 to 44	1.09
45 to 51	1.08

Coefficient of position and dispersion:

$$CPK = min\left(\frac{Tolmax - \bar{X}}{3\sigma_0} \middle| \frac{\bar{X} - Tolmin}{3\sigma_0}\right)$$

The station is "capable" if the CAM is higher than the "specified CAM".

The setting is correct if the CPK is higher than the "specified CPK".

4 - ISO STANDARD

Standard deviation:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N} (xi - \bar{X})^2}{N - 1}}$$

where:

$$\bar{X} = \frac{\sum_{i=1}^{N} xi}{N}$$ population mean.

xi population value.

N : number of measurements of the population.

Process Capability:

$$CP = \frac{IT}{6\sigma}$$

where:

IT = tolerance interval = Max. Tol. - min.Tol.

σ = standard deviation

Coefficient of position and dispersion:

$$CPK = min\left(\frac{Tolmax - \bar{X}}{3\sigma} \middle| \frac{\bar{X} - Tolmin}{3\sigma}\right)$$

5 - NF E 60-181 STANDARD

S_{ie} = Estimator of the intrinsic standard deviation for each mode number.

where:

2 ≤ e ≤ k

and **k** is the number of samples.

$$S_{ie} = \sqrt{\frac{\sum_{j=1}^{n} (x_{je} - \bar{x}_e)^2}{n - 1}}$$

where:

$$\bar{x}_e = \frac{\sum_{j=1}^{n} x_{je}}{n}$$

n = Size of the sample.

$$S_i = \sqrt{\frac{1}{k} \sum_{e=1}^{k} S_{ie}^2}$$

$$Di = 6 \times S_i$$

IT = Tolerance interval.

$$CAM = \frac{IT}{D_i}$$

$$S_p = \sqrt{\frac{\sum_{j=1}^{n} (x_j - \bar{x})^2}{N - 1}}$$

where:

$$\bar{x}_e = \frac{\sum_{j=1}^{n} x_j}{N}$$

$$Cpk = Min\left[\left(\frac{L_S - x}{3s_p}\right), \left(\frac{x - L_S}{3s_p}\right)\right]$$

$$Cap = \frac{IT}{6s_p}$$

6 - NORMAL DISTRIBUTION TESTS

Normal distribution test: population of less than 50 measurements (SHAPIRO-WILK test).

Calculation of:

$$S^2 = \sum_{i=1}^{N} (x_i - \bar{x})^2$$

where:

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{N}$$

N : number of measurements of the population.

Calculation of:

$$b = \sum_{i=1}^{k} a_i \; d_i$$

where:

$$d_i = X_{N-\,i+1} - x_i$$

ai : see table.

K = N/2 if N is even

K = (N-1) / 2 if N is odd

I/N	15	20	25	30	35	40	45	50
1	0.5150	0.4734	0.4450	0.4254	0.4096	0.3964	0.3850	0.3751
2	0.3306	0.3211	0.3069	0.2944	0.2834	0.2737	0.2635	0.2574
3	0.2495	0.2565	0.2543	0.2487	0.2427	0.2368	0.2313	0.2260
4	0.1878	0.2085	0.2148	0.2148	0.2127	0.2098	0.2065	0.2032
5	0.1353	0.1686	0.1822	0.1870	0.1883	0.1878	0.1865	0.1847
6	0.0880	0.1334	0.1539	0.1630	0.1673	0.1691	0.1695	0.1691
7	0.0433	0.1013	0.1283	0.1415	0.1487	0.1526	0.1545	0.1554
8	0.0000	0.07111	0.1046	0.1219	0.1317	0.1376	0.1410	0.1430
9		0.0422	0.0823	0.1036	0.1160	0.1237	0.1286	0.1317
10		0.0140	0.0610	0.0862	0.1013	0.1108	0.1170	0.1212
11			0.0403	0.0697	0.0873	0.0986	0.1062	0.1113
12			0.0200	0.0537	0.0739	0.0870	0.0959	0.1020
13			0.0000	0.0381	0.0610	0.0759	0.0860	0.0932
14				0.0227	0.0484	0.0651	0.0765	0.0846
15				0.0076	0.0361	0.0546	0.0673	0.0764
16					0.0239	0.0444	0.0584	0.0685
17					0.0119	0.0343	0.0497	0.0608
18					0.0000	0.0244	0.0412	0.0532
19						0.0146	0.0328	0.0459
20						0.0049	0.0245	0.0386
21							0.0163	0.0314
22							0.0081	0.0244
23							0.0000	0.0174
24								0.0104
25								0.0035

Calculation of:

$$W = b^2 S^2$$

There is a 5% probability of not having a normal distribution if W is lower than W95 given in table :

N	W95
15	0.881
20	0.905
25	0.918
30	0.927
35	0.934
40	0.940
45	0.945
50	0.947

Normal distribution test: population of more than 50 measurements (CHI-CARRE test).

1) Distribute into classes of at least 4 or 5 measurements.

2) Calculate the mean and standard deviation.

mean:

$$X = \frac{\sum x_i}{N}$$

standard deviation:

$$\sigma = \sqrt{\frac{\sum (xi - \overline{X})^2}{N - 1}}$$

3) Calculate for each class limit:

$$u_i = \frac{(l_i - \overline{X})}{\sigma}$$

4) Calculate:

$$X^2 = \sum \frac{(n_i - n_i')^2}{n_i'}$$

where:

n = number of measurements in class i.

n' = theoretical number of measurements for a normal distribution

$$n_i' = N\,[\,F(u_i) - F(u_{i-1})]$$

F(ui): reduced table of normal distribution, there is a 5% probability of not having a normal distribution if X^2 is higher than X^2 given in table below.

d	X^2
1	3.84
2	5.99
3	7.81
4	9.49
5	11.07
6	12.59
7	14.07
8	15.51
9	16.92
10	18.31

d	X^2
11	19.67
12	21.03
13	22.36
14	23.68
15	25.00
16	26.30
17	27.59
18	28.87
19	30.14
20	31.41

7 - CONTROL CHARTS

"Mean - Range" control chart

1) Upper and lower check limits of the mean

Lower limit:

$$l_i = \overline{X} - A2\overline{W}$$

Upper limit:

$$l_s = \overline{X} + A2\overline{W}$$

where:

A2 = 0.577 for samples of 5 measurements.

W = mean range for each sample.

2) Upper and lower check limits of the range

Lower limit:

$$l_i = D3\overline{W}$$

Upper limit:

$$l_s = D4\overline{W}$$

where:

D3 = 0

D4 = 2.114

"Mean - Standard deviation" control chart

1) Upper and lower check limits of the mean.

Lower limit:

$$l_i = \overline{X} - A3\overline{\sigma}$$

Upper limit:

$$l_s = \overline{X} + A3\overline{\sigma}$$

where:

A3 = 1.427

2) Upper and lower check limits of the standard deviation.

Lower limit:

$$l_i = B3\overline{\sigma}$$

Upper limit:

$$l_s = B4\overline{\sigma}$$

where:

B3 = 0

B4 = 2.089

$\overline{\sigma}$: mean of the standard deviations for each sample (5 measurements).

For each sam ple, the standard deviation is calculated as follows:

$$\sigma = \sqrt{\frac{\sum (x_i - \overline{X})^2}{N - 1}}$$

1 - CVI3 LOGICAL OUTPUTS

1.1 - Lockout

Name	Description	Rising condition	Falling condition
Span failure	When starting a tightening and before running the tool, the controller checks the torque span. This output is activated if the span drift is more than ±3%, causing a tool lockout. This fault can be due to a torque transducer or a tool electronics failure.	Span failure detection	Disconnecting tool or new check without fault.
Offset failure	The offset (0 point) drifts by 50% of full scale or more. This error exists when, at the beginning of the tightening operation, the torque transducer is seen to have 50% or more of full-scale torque prior to even starting the motor. With an offset failure, the controller cannot adequately compensate for this transducer error and, therefore, will not allow a tightening operation to occur. Offset failures can come from a severely damaged torque transducer, cable or controller.	Offset failure detection	Disconnecting tool or new check without fault.
No tool connected	The controller is not detecting the tool.	No tool connected or tool not recognized	Tool connected and recognized.
Motor over temperature	The temperature of the tool motor windings has exceeded the temperature security limits: 100°C max. for fixed tools 60°C max. for portable tools"	Motor temperature threshold exceeded.	The signal turns off when the temperature returns below the limits plus -10°C.
Angle measurement fault	Angle sensor fault detected by servo-drive. It can be a sensor fault or tool electronic fault or both.	Angle sensor fault.	Disconnecting tool or new check without fault.
Invalid spindle settings	Tool characteristics do not match Pset parameters (e.g. negative jog times or contradictions, torque over the maximum tool torque range, speed over the maximum tool speed).	Pset selection or tool connection.	Tool disconnection or new Pset selected.
Invalid Pset selected	The selected Pset failed. Pset number does not exist in the controller.	Pset selection failed.	Pset selection succeeded
Lock on reject	The tool is locked after a rejected tightening operation. The controller will not continue to operate the tool depending on “lock on reject option “: - until the "Error Acknowledge" input is activated - until a run reverse operation - until a loosening operation	Tightening finished with NOK result and option “lock on reject” activated.	"Error acknowledge" input activated or run reverse operation or loosening operation.
Tightening running	The tightening operation has actually started: the tool is running and the torque is over the start torque threshold.	Torque reachs the start torque threshold.	The tightening operation is finished.
Tightening finished	The Pset report is available.	Result generation.	New start (tool trigger or external start) or reset input
Pset selected bit 0-7	Echoes the binary "Pset selected bit 0-7" input if the corresponding Pset exits. Echoes 0 if the Pset does not exist.	New Pset selected	New Pset selected
Tightening OK	The tightening operation (for a specific tightening unit) is successful and all tightening parameters are within their tolerances.	Result generation.	New start (tool trigger, external start) or reset input
Tightening NOK	The tightening operation (for a specific tightening unit) has failed.	Result generation.	New start (tool trigger or external start) or reset input
Spindle OK	The tightening operation (for a specific spindle) is successful and all tightening parameters are within their tolerances.	Result generation.	New start (tool trigger or external start) or reset input
Spindle NOK	The tightening operation (for a specific spindle) has failed.	Result generation.	New start (tool trigger or external start) or reset input

Name	Description	Rising condition	Falling condition
Angle low	The tightening angle report is below the minimum value.	Result generation.	New start (tool trigger or external start) or reset input
Angle high	The tightening angle report is above the maximum value.	Result generation.	New start (tool trigger or external start) or reset input
Angle OK	The tightening angle report is correct.	Result generation.	New start (tool trigger or external start) or reset input
Torque low	The tightening torque report is below the minimum value.	Result generation.	New start (tool trigger or external start) or reset input
Torque high	The tightening torque report is above the maximum value.	Result generation.	New start (tool trigger or external start) or reset input
Torque OK	The tightening torque report is correct.	Result generation.	New start (tool trigger or external start) or reset input
Remove fastener	The tightening operation has exceeded the “Remove Fastener” limit. There is a risk that the tightening operation is not reliable: disassemble the joint and check parts.	Result generation.	New start (tool trigger or external start) or reset input
Overall time reached	The maximum overall time has been reached.	Result generation.	New start (tool trigger or external start) or reset input
Tight finished no timeout	Tightening is finished without overall timeout.	Result generation.	New start (tool trigger or external start) or reset input
Batch finished	The batch count has been completed whatever the reports.	The batch is finished.	New start (tool trigger or external start) or reset input
Batch OK	The batch count is complete. All tightenings are OK or forced as OK.	The batch is finished and OK.	New start (tool trigger or external start) or reset input
Batch NOK	The batch count is complete. Some tightenings are NOK or forced as NOK or the AP has been aborted.	The batch is finished and NOK. A new AP has been selected.	New start (tool trigger or external start) or reset input
Batch running	A batch process is running.	A batch operation is enabled	The batch is finished or the input reset
Current batch count bit 0-6	Bit indicator of current batch count. Binary coded.	Batch count increment	Batch finished/new start (tool trigger or external start) / reset input /new AP selection.
Remaining batch count bit 0-6	Bit indicator of the number of remaining tightenings in the batch.	Batch count increment	Batch finished/new start (tool trigger or external start) / reset input /new AP selection.
Assembly Process selected bits 0-7	The Assembly Process currently selected.	New AP selected or AP aborted	New AP selected or AP aborted
AP finished	The Assembly Process is complete whatever the reports.	AP finished.	New AP start or reset input
Assembly Process OK	The Assembly Process is successful.	AP finished and OK.	New AP start or reset input
Assembly Process NOK	The Assembly Process is complete with reject tightenings or the Assembly Process has been aborted.	AP finished and NOK or AP aborted.	New AP start or reset input
Assembly Process running	The Assembly Process is being processed.	AP start.	AP finished or aborted.
Assembly Process aborted	The Assembly Process has been aborted.	Assembly Process aborted.	A new Assembly Process start or reset input

1.2 - General

Name	Description	Rising condition	Falling condition
Ready	The Tightening Unit is ready to run.	No internal error (tool/controller communication/ hardware)	Quick stop activated. Error coming from tool (except torque or span error)
Yellow report	State of yellow light on controller.	The yellow light is on	A new tightening operation starts
Green report	State of green light on controller.	The green light is on	A new tightening operation starts
Red report	State of red light on controller.	The red light is on	A new tightening operation starts
Manual reverse in progress	The reverse direction is active or a loosening operation is running.	Run reverse selected and tool running.	The tool is not running.
Fastener loosened	The fastener is loosened within the Run reverse limits.	Result generation.	New start (tool trigger or external start)
Fieldbus Fault	The fieldus communication is lost due to : - cable disconnection - cable failure - Fieldbus module disconnection. - keep alive timeout	Communication lost.	Communication established.
Reporting Alarm	The Toolsnet or CVINet FIFO threshold alarm has been reached. The results are stored in the controller FIFO memory and are erased once sent to Toolsnet or CVINet. To detect communication issues, the software measures the memory fill in rate (%). When the target threshold is reached, the "Reporting alarm" output switches on.	FIFO Threshold Alarm reached	FIFO under threshold alarm.
Identifier OK	Identifier received and identified (e.g. barcode).	Identifier received and identified	0,5 s after rising
Identifier NOK	Identifier received but not identified (e.g. barcode).	Identifier received but not identified	0,5 s after rising
Keep alive ack	This output is the copy of the "Keep alive" input. It can be used by the PLC to check that the controller is still running.	When "Keep alive" input rises.	When "Keep alive" input falls.
User info present	3 levels of user information: Info/Warning/Error.	The user information is displayed	The user information is not displayed

1.3 - External outputs

Name	Description	Rising condition	Falling condition
PLC external output 1-10	The output is controlled by PLC via Fieldbus (like a remote I/O).	Managed by PLC	Managed by PLC
AP external output 1-10	The output can be set or reset within an Assembly Process	Managed by AP	Managed by AP
OP external output 1-10	The output is dedicated to Open Protocol.	Managed by OP	Managed by OP

1.4 - Tool status

Name	Description	Rising condition	Falling condition
Tool direction	The tool is running forward.	Tool direction in forward direction.	Tool direction in reverse direction.
Tool tightening	The tool is running forward. Start torque threshold is not taken into account.	Tool starts in forward direction.	Tool stops.
Tool not lock forward	There is no tool lock in forward direction.	Tool unlocked in forward direction	New lock in forward direction
Tool not lock reverse	There is no tool lock in reverse direction.	Tool unlocked in reverse direction	New lock in reverse direction
Tool ready	Tool is ready to tight: - Tool is present and controller is ready. - A valid Pset is selected.	Tool connected and valid Pset.	Tool disconnection.Pset selection.
Tool running	The tool is rotating.	The tool rotates.	The tool stops.

Tool middle course trigger	The tool middle course trigger is detected.	Main trigger middle course is reached.	Main trigger is released.
Tool main trigger	The tool main trigger is detected.	Main trigger is pushed.	Main trigger is released.
Tool reverse trigger	The tool reverse trigger is detected.	Reverse trigger is pushed.	Reverse trigger is released.
Tool push or front trigger	The tool push or front trigger is detected.	Push or front trigger is pushed.	Push or front trigger is released.

1.5 - Socket tray

Name	Description	Rising condition	Falling condition
Socket selectable 0-4	Used with CVI II socket tray (BSD) only. Binary code. Informs the user which socket can be taken.	A new socket has to be taken by the user.	No socket to be taken by the user.

2 - CVI3 LOGICAL INPUTS

2.1 - General

Name	Description	Status
Start/Stop Tightening on state	Initiates a tightening operation. A rising edge must be detected to initiate a tightening operation. If this input becomes inactive at any time during the tightening, the tool will stop running. At the end of tightening, a new tightening begins only if the signal falls and then rises.	State
Start/stop tightening on edge	This input is only enabled for fixed tools without trigger. Initiates or ends a tightening operation. A rising edge initiates a tightening. A falling edge has no effect during tightening. If a tightening is in execution, a rising edge will stop it.	Rising edge
Reverse direction	When this input is activated, the tool green & red lights are flashing to indicate that reverse direction is selected. This signal status is not controlled during a tightening but only when the tool is not running.	State
Pset selected bit 0-7	Used to select Parameter sets (up to 250). Binary coded.	State
Spindle validation forward	Enables the tool forward direction.	State
Spindle validation reverse	Enables the tool reverse direction.	State
Error acknowledge	Enables the "Reject Lockout" function. Once locked, a tool cannot work until this input is activated.	Rising edge
Reset	When "Reset" input rises: - tool and controller reports lights are set off - the last result values on display are readable - tightening is immediately stopped - no reports are generated - tool is locked - defaults are acknowledged - batch counter of the current Assembly Process is reset - in Pset mode, the selected Pset remains unchanged. - In Assembly Process mode, the process is aborted. - "Ready" output stays on.	State
Reset only status	Resets only: - Tightening OK/NOK - Spindle OK/NOK - Tightening Finished - Tightening finished without timeout - Batch OK/NOK/Finished The Assembly Process is not aborted. Result values (angle, torque) are still present in Fieldbus. Tool and controller lights are not affected.	State

Name	Description	Status
External stop abort Pset	Used with proximity detectors to end the running Pset. The user can choose which state or transition will stop the Pset : No, Rising, Falling, Change, High, Low. When a Pset is aborted, the result is NOK.	Rising edge or state
External stop to next step	Used with proximity detectors to end the running step. The user can choose which state or transition will stop the step : No, Rising, Falling, Change, High, Low. The user can also choose the result of the step when the stop request occurs: OK, NOK, Monitoring.	Rising edge or state
Restart Controller	To reboot the controller.	Rising edge
Ack error message	Acknowledge error message displayed on HMI.	Rising edge
Keep alive	To check that the controller is still alive. State of this input is copied to "Keep alive ack" output This input can be used by PLC to inform the controller that Fieldbus communication is working.	State
Select next Pset	To select the next existing Pset number.	Rising edge
Select previous Pset	To select the previous existing Pset number.	Rising edge
Assembly Process selection bit 0-7	To select an Assembly Process (up to 250).	Rising edge
Abort Assembly Process (Tightening unit)	To stop the current Assembly Process. The Assembly Process is finished. "AP aborted" and "AP NOK" outputs are set.	Rising edge
Restart Assembly Process (Tightening unit)	The Assembly Process restarts at the beginning when “Restart Assembly Process” is set.	Rising edge
Restart batch	To re-start the current batch of the current Assembly Process step (batch count: o/x) "Restart action batch" event is set.	Rising edge

2.2 - Tools

Name	Description	Status
Tool stop	To stop the tool.	Rising edge
Tool blue light	1 = tool blue light is set to on 0 = tool blue light is set to off	State
Tool green light	1 = tool green light is set to on 0 = tool green light is set to off	State
Tool red light	1 = tool red light is set to on 0 = tool red light is set to off	State
Tool yellow light	1 = tool yellow light is set to on 0 = tool yellow light is set to off	State
Tool white light	1 = tool white light is set to on 0 = tool white light is set to off	State
Reset tool locks	To reset tool locks. Only the non safety locks are affected.	Rising edge

2.3 - External inputs

Name	Description	Status
PLC external input 1-10	Inputs are controlled by PLC via Fieldbus (like a remote I/O).	State
AP external input 1-10	Inputs used in Assembly Process: - in "Start conditions" by using "Input event" - in "Process actions" by using "Sense input"	Rising edge
OP external input 1-8	Inputs controlled via Open Protocol.	State

2.4 - Socket tray

Name	Description	Status
Socket lifted bit 0-4	Only used with CVI II sockets. Informs which socket has been lifted. Binary coded.	State

APPENDIX - USER INFO CODES

Error code no.	Description	Resolution procedure
1	Tubenut open	1- The tubenut tool is detected as open
2	Tool connected	1- The tool has been connected and recognized correctly by the controller.
3	No tool connected	1- The tool has been disconnected. 2- If the tool is not physically disconnected, check the tool cable.
4	Span failure	1- Span value from torque sensor is outside bounds 2- Try once again to start the tool without any mechanical constraints. If the problem occurs again, contact your Desoutter representative for support
5	Offset failure	1- Offset value from torque sensor is outside bounds 2- Try once again to start the tool without any mechanical constraints.If the problem occurs again, contact your Desoutter representative for support
6	Tool motor rotor locked	1- Unable to start tool motor (rotor is locked), change your tool 2- Contact your Desoutter representative for support
7	Tool motor too hot	1- Tool is locked because its maximum motor temperature has been reached (to avoid any damage) 2- Tool will remain locked as soon as motor temperature comes back to its normal value
8	Tool angle fault	1- Problem detected with the tool angle sensor 2- The tool needs maintenance. Contact your Desoutter representative for support
9	Tool invalid parameters	1- The tool memory cannot be read or is invalid. 2- The tool needs maintenance.
10	Tool calibration alarm date expired	1- The tool calibration date expired 2- A tool calibration procedure needs to be done to ensure the measurement accuracy.
12	Tool EEPROM could not be read	1- The tool memory cannot be read or is invalid. 2- The tool needs maintenance. If the problem occurs again, contact your Desoutter representative for support.
13	Tool motor bad ground connection	1- Phase-phase or phase to ground shortcircuit. 2- Disconnect the tool. Contact your Desoutter representative for support.
14	Tool torque power default	1- The torque sensor is not corrrectly supplied 2- The tool needs maintenance. If the problem occurs again, contact your Desoutter representative for support.
15	Tool locked on reject	1- The tool is locked forward after a NOK. 2- Unlock the tool by according to lock on reject option i.e. by reversing, loosening or digital input.
16	Tool locked by Open Protocol	1- Tool has been locked by Open Protocol 2- Unlock the tool by sending an Enable tool message via Open Protocol
17	Loosening prohibited	1- Loosening is prohibited. 2- The loosening is disabled in the Assembly operation 3- The batch count type OK + NOK is used.
18	Tool torque out of range	1- The target torque value is above the tool max. torque. 2- Check Pset settings with tool characteristics.
19	Tool communication error	1- Tool communication error. 2- Check tool and cable connections. If the problem occurs again, contact your Desoutter representative for support.
20	Tool over current	1- Tool leds are not corrrectly supplied 2- Disconnect and reconnect the tool. If the problem occurs again, contact your Desoutter representative for support.
21	Number of retries reached	1- The number of retries max has been reached. 2- The tool is locked. 3- The running Assembly Process has to be aborted.
22	Tool locked, lift correct socket	1- The tool is locked, the CVI3 is waiting for the correct socket to be lifted
23	Unsupported tool	1- The tool connected to the CVI3 is not supported 2- Contact your Desoutter representative for more information
24	Tool loosening prohibited by VW XML	1- Loosening is disabled by VWXML protocol
25	Tool tightening prohibited by VW XML	1- Tightening is prohibited by VWXML protocol
100	Cable invalid parameters	1- Problem detected with the cable (memory cannot be read). 2- Change the cable. If the problem occurs again, contact your Desoutter representative for support
101	Cable not detected	1- Tool communication error. Check cable connection 2- If problem occured again, Contact your Desoutter representative for support
199	Serial console activated	1- The serial console is activated. 2- Warning: this console is dedicated to debug purposes only and should not be used in production.

Error code no.	Description	Resolution procedure
200	Quick stop activated	1- The quick stop has been activated 2- Check your Phoenix contact
201	Replace backup battery	1- The real time clock backup battery needs to be replaced.
202	Fieldbus connection lost	1- Fieldbus connection with PLC is lost - no heartbeat is received from PLC - the cable is broken or disconnected - the PLC is off line or not powered 2- Check the Fieldbus configuration.
204	Spindle not validated by IO	1- Spindle locked by I/O. 2- Check the I/O settings: the "Spindle validation" must be active to unlock the tool.
205	Torque settings and tool mismatch	1- Invalid Torque setting, torque is greater than tool characteristics 2- Check Pset settings with the current tool characteristics
206	Speed settings and tool mismatch	1- Invalid speed setting, speed is greater than tool characteristics 2- Check Pset settings with the tool max. speed.
207	Assembly process done	1- Assembly Process is done, the tool is locked 2- Select new Assembly Process to unlock the tool
208	Invalid run reverse parameters	1- Invalid Run reverse setting, torque or speed are greater than tool characteristics or reverse strategy is not supported 2- Check Pset settings with the current tool characteristics
209	Pset conversion failed	1- Software internal error. 2- Pset is corrupt. Try to download it to the controller. If the error persists, contact your Desoutter representative for support
210	Invalid Pset selected	1- The Pset currently selected does not match the selectable one in the Assembly Process.
211	Invalid trigger configuration	1- The tool currently connected to the CVI3 is not equipped with the trigger required by the tool trigger configuration 2- Adjust your tool trigger configuration to the tool connected or change the tool according to the expected trigger configuration
212	Result could not be persisted	1- It was not possible to persist the tightening result in the controller 2- Contact your Desoutter representative for support
213	Drive connection lost	1- Connection with the drive has been lost 2- Reboot the controller 3- If issue remains contact your Desoutter representative
214	RS232 power short circuit	1- Serial peripheral default. 2- Disconnect and reconnect. 3- Check the serial peripheral.
215	Drive current calibration failed	1- Current calibration failed. 2- Try once again. 3- If the problem occurs again, contact your Desoutter representative for support.
216	Drive current too high	1- Max current exceeded. 2- Contact your Desoutter representative for support
217	Drive disabled	1- Drive disabled by external source. 2- Contact your Desoutter representative for support
218	Drive gate voltage too low	1- Drive hardware failure. 2- Safety issue: contact your Desoutter representative for support
219	Hardware channel failure	1- Drive hardware failure. 2- Safety issue. Contact your Desoutter representative for support.
220	Hardware trip	1- Drive hardware failure. 2- Safety issue: contact your Desoutter representative for support.
221	Drive heart bit error	1- Drive hardware failure. 2- Safety issue: contact your Desoutter representative for support.
222	Drive heatsink temperature high	1- Heatsink too warm. 2- Let the controller cool down.
223	Drive init failure	1- Software failure. 2- Restart the controller. 3- If the problem occurs again, contact your Desoutter representative for support.
224	Drive junction temperature high	1- Power electronics too warm. 2- Let the controller cool down.
225	Drive missing angle	1- Tool communication error. Check tool and cable connections. 2- Try once again, if the problem occurs again, contact your Desoutter representative for support.
226	Drive missing torque	1- Tool communication error. Check tool and cable connections. 2- Try once again, if the problem occurs again, contact your Desoutter representative for support..
227	Drive motor stalled	1- Motor stalled (could be missing phase, wrong motortune or power electronics failure) 2- Try once again, if the problem occurs again, contact your Desoutter representative for support.

Error code no.	Description	Resolution procedure
228	Drive Software Error	1- Software failure 2- Restart the controller. 3- If the problem occurs again, contact your Desoutter representative for support
229	Drive PWM watchdog error	1- Software failure. 2- Restart the controller. 3- If the problem occurs again, contact your Desoutter representative for support.
230	Drive DC bus voltage high	1- Max current exceeded. DC-bus voltage high 2- Contact your Desoutter representative for support
231	Drive DC bus voltage too low	1- Power failure. DC-bus voltage low 2- Contact your Desoutter representative for support.
232	Fieldbus module not recognized not a Desoutter one	1- The Fieldbus module plugged in the CVI3 cannot be run it is not an authorized Desoutter module. 2- Contact your Desoutter representative for more information.
233	CVINet FIFO full	1- The CVINet result FIFO is full, the CVINet connection has been lost 2- Check the CVI3 Ethernet cable 3- Check CVI3 Ethernet configuration 4- Check if CVINet is running correctly
234	Fieldbus module mismatch	1-The Fieldbus module declared in configuration is not the same that the one present in controller (e.g. Profibus declared but a Profinet module in CVI3).
235	Warning max speed setting	1- Invalid speed setting: speed is greater than tool characteristics 2- By default, speed setting has been replaced with tool max speed.
236	Toolsnet FIFO full	1- The ToolsNet result FIFO is full, the CVINet connection has been lost 2- Check the CVI3 Ethernet cable 3- Check CVI3 Ethernet configuration 4- Check if ToolsNet is running correctly
237	Fieldbus invalid process data	1- The Fieldbus mapping has too many items.
238	Fieldbus invalid device address	1- The device address affected to Fieldbus is invalid.
239	Fieldbus invalid communication settings	1- Fieldbus communication settings are invalid.
240	VW XML protocol not authorized	1- The selected XML protocol is not authorized (check the ePOD characteristics)
300	Save log started	1- Saving the CVI3 logs to USB key has started
301	Save log done	1- Saving the CVI3 logs to USB key has ended
310	Identifier accepted	1- An identifier has been received and accepted. 2- The identifier is matching an Assembly process start condition
311	Identifier rejected	1- An identifier has been received 2- The identifier does not match any Assembly process start condition
312	Access rights expired	1- The access rights on the USB key could not be read 2- Try unplugg the key and insert it again 3- If the issue is persistent, the access right file is probably corrupt 4- Contact your CVI Key administrator
313	Access rights not readable	1- The access rights on the USB key could not be read 2- Try unplugg the key and insert it again 3- If the issue is persistent, the access right file is probably corrupt 4- Contact your CVI Key administrator
400	Default network configuration set	1- Network configuration has been set to default.
401	Network configuration failed	1- Network configuration failed. 2- Check your settings. 3- If the problem occurs again, contact your Desoutter representative for support.
900	CVI3 Software update failed	1- The SW upgrade failed 2- Do not remove the USB key and try to restart the CVI3 3- If the upgrade is still failing, contact your Desoutter representative
901	CVI3 Software image not found	1- The SW upgrade failed, no CVI3 image (*.cvi3) was found at the USB key root directory 2- Check your USB key, it must have only one CVI3 image
902	CVI3 Software image invalid	1- The SW upgrade failed, the CVI3 image copied on your USB key is corrupted 2- Remove and copy again your CVI3 image 3- Try another USB key 4- Contact your Desoutter representative for more information
903	CVI3 Software updater missing	1- The SW updater is not available or broken 2- Contact your Desoutter representative for more information
904	CVI3 save parameter utility not found	1- The save parameters utility is not available 2- Contact your Dessouter representative for upgrade
905	CVI3 save parameter to key failed. Key is full	1- Your USB key is full, all data was not saved 2- Delete your old backup files and try again

Error code no.	Description	**Resolution procedure**
906	CVI3 save parameter failed	1- An error occurred during data backup, all data was not saved 2- Check available space on your USB key, delete some old backup and try again 3- If the issue is persistent, contact your Dessouter representative for more information.
907	Wrong USB port	1- Your USB device is plugged into the wrong port 2- If your device is a USB key, plug it into the USB front port 3- If your device is a USB barcode reader or keyboard, plug it into the bottom USB ports
908	Too many USB HID devices connected	1- Too many USB devices (barcode reader or keyboard) are attached on your controller 2- Remove all devices and plug again on bottom USB ports only
909	USB HID device error	1- Your USB device is not supported by the CVI3 controller 2- Only USB barcode reader and USB keyboard are supported, if you use one of them, contact your Dessouter representative for upgrade

1 - GENERAL

1.1 - Statement of use

This document is a user manual about the Fieldbus module installation and the programming of the CVI3 range controllers.

No other use permitted.

For professional use only.

1.2 - Terminology

AP	Assembly Process
PLC	Programmable Logic Controller
TU	Tightening Unit

2 - HARDWARE INSTALLATION

2.1 - Module selection

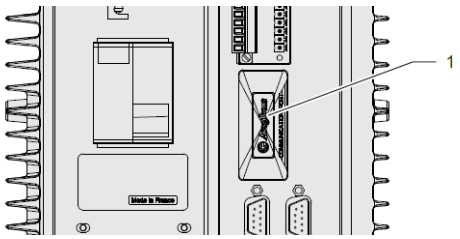
To be able to communicate on Fieldbus, the controller needs a dedicated Fieldbus module. The following modules are available:

Fieldbus certificates are available on request. Contact your Desoutter representative.

Part number	Fieldbus type	Module type
6159275980	CC-Link	
6159275990	DeviceNet	
6159275940	EtherNet/IP	
6159276150	Modbus-IDA	
6159275950	PROFIBUS	
6159275960	PROFINET 1 port	
6159275970	PROFINET 2 ports	

2.2 - Module installation

- Power off the controller.
- Locate the Fieldbus connector at the bottom panel (see picture below). The cover is protected by a grey cover.



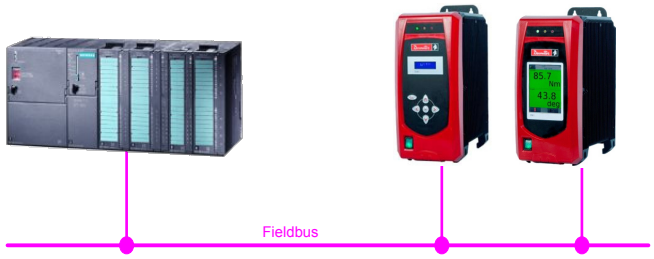
Legend
1 Fieldbus connector

- Remove the cover
- Carefully drive the Fielbus module into its location.
- Tighten the 2 screws by using a T9 Torx screwdriver.
- Power on the controller.

3 - CONFIGURATION

3.1 - Principle of operation

The purpose of Fieldbus is to share reliable data between the controller and the PLC. Generally, the PLC is the master and the controllers are slaves (i.e. the PLC is in charge of writing or reading data in the controller memory when needed).

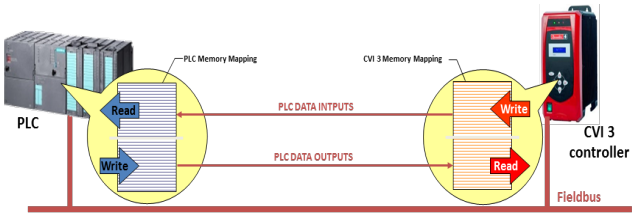


- Depending on the Fieldbus type, you will have to select:
- the Identification method (station address, IP address, station name)
- the speed, media and expected performances.

To establish the communication, the controller and the PLC must agree about the data they exchange: the user must define exactly the same thing on both sides.

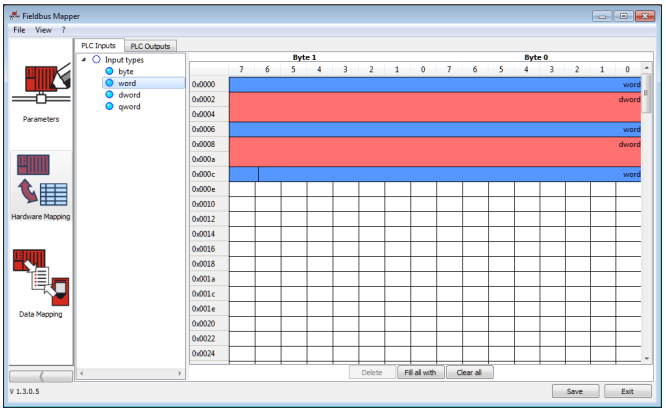
There are 2 mappings to configure:

- Hardware mapping where is defined which raw data types are exchanged (e.g. byte, words, double words)
- Data mapping where is defined what is the meaning of data exchanged (e.g. final torque, tightening result).



3.2 - Example: default configuration

As example of hardware mapping, here is the default hardware mapping:



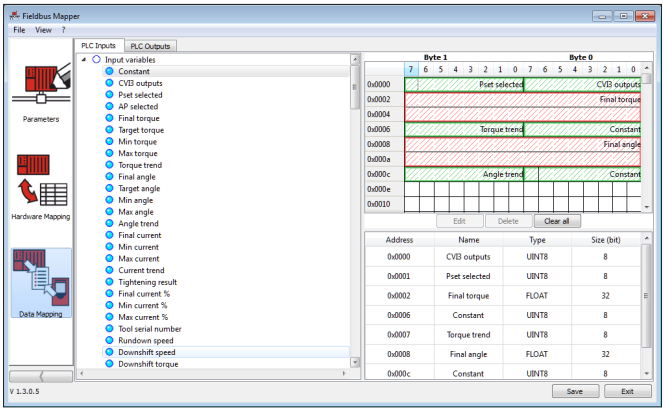
In this mapping, the PLC can read (PLC inputs) 14 bytes organized as follows:

A word	16 bits	at address 0
A double word	32 bits	at address 2
A word	16 bits	at address 6
A double word	32 bits	at address 8
A word	16 bits	at address 12

The PLC can write (PLC outputs) 2 bytes organized as:

A word	16 bits	at address 0

Here is the default data mapping:



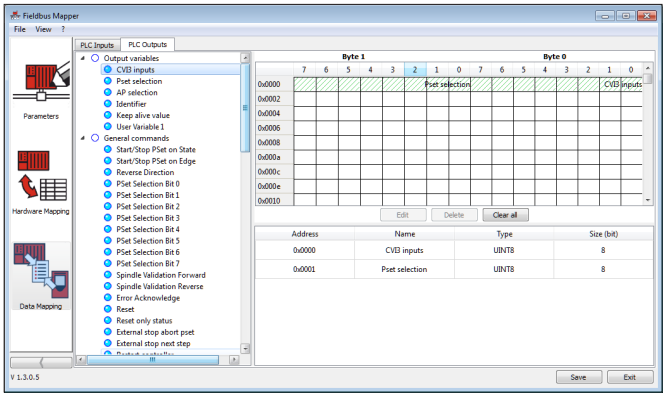
A meaning (a variable) has been associated to each address (e.g. Pset selected, Torque Trend). Note that the hardware mapping and the data can be completely different. The only rule to respect is to put a variable only at the address where a hardware item has been declared.

In the screenshot above are represented the PLC's inputs (i.e. data coming from CVI3 to PLC).

The default configuration is:

Address	Name	Description	Format	Size
0	CVI3 outputs	State of the 8 CVI3 outputs. By default, there are no ouputs activated on CVI3. In CVIPC, you can active a default output configuration by clicking on "set default" in "I/O and accessories" panel.	UINT8	8 bits
1	Pset selected	Id of Pset currently selected	UINT8	1 byte
2	Final torque	Final torque in Nm (last step)	FLOAT	4 bytes
7	Torque trend	Torque trend (last step) 0 = no result 1 = min 2 = max 3 = accepted	UINT8	1 byte
8	Final Angle Target	Final angle in degrees (last step)	FLOAT	4 bytes
13	Angle trend	Angle trend (last step) 0 = no result 1 = min 2 = max 3 = accepted	UINT8	1 byte

There are also data coming from PLC to CVI3:

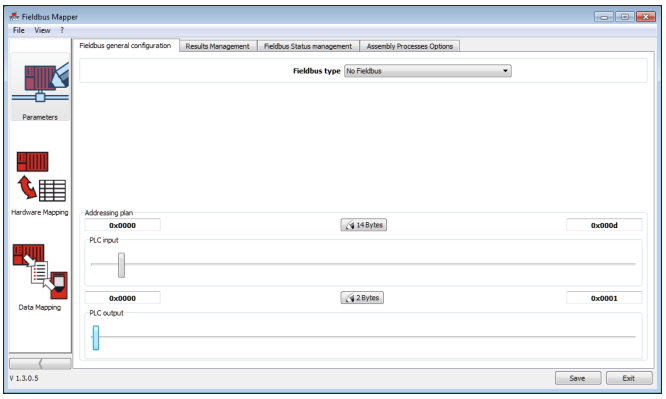


Address	Name	Description	Format	Size
0	CVI3 inputs	State of the 8 CVI3 inputs that can be forced by PLC. By default, CVI3 inputs are: Input 1 : Pset selection bit 0 Input 2 : Pset selection bit 1 Input 2 : Pset selection bit 2 Input 4 : Input 5 : Acknowledge error Input 6 : Start/stop tightening on state Input 7 : Reverse direction	UINT8	8 bits
1	Pset selection	Id of Pset expected by PLC	UINT8	1 byte

4 - GENERAL CONFIGURATION

	In CVIPC software, click on this icon to launch the Fieldbus configuration.

The following screen is displayed:



4.1 - Fieldbus general configuration

In this panel, you can configure the main parameters needed to communicate between the PLC and CVI3 controller.

4.1.1 - Endianness

- By default, CVI3 express all binary values in Big-Endian endianness. For example, the representation in the CVI3 memory of the 32 bits value 0x11223344 is:

Address	0	1	2	3
Value	0x11	0x22	0x33	0x44

Of course, the PLC can have different representation of binary values in its memory. To allow CVI3 to cope with this different configuration, the user can choose different formats of binary representation (examples for value 0x11223344):

Setting	Address			
	0	1	2	3
No-used (ABCD|ABCD)	0x11	0x22	0x33	0x44
Swap reverse only (ABCD|DCBA)	0x44	0x33	0x22	0x11
Swap word only (ABCD|BADC)	0x22	0x11	0x44	0x33
Swap reverse/word (ABCD|CDAB)	0x33	0x44	0x11	0x22

4.1.2 - Addressing plan

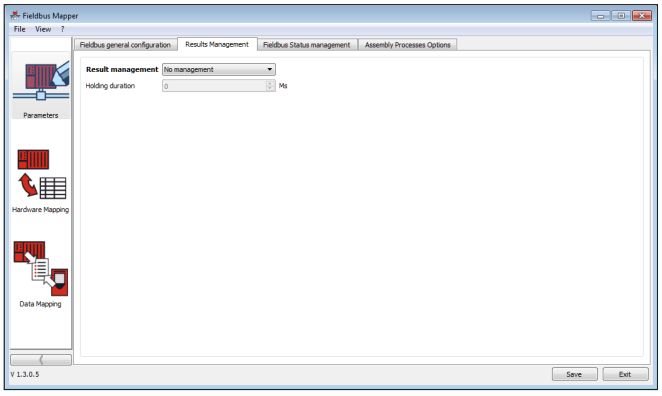
- In this panel, the user can set size of data exchanged between PLC and CVI3.

In this example:

- 14 bytes of data (start at address 0x0 until address 0xD included) are defined for data coming from CVI3 to PLC.
- 2 bytes of data (start at address 0x0 until address 0x1 included) are defined for data coming from PLC to CVI3.

4.2 - Result management

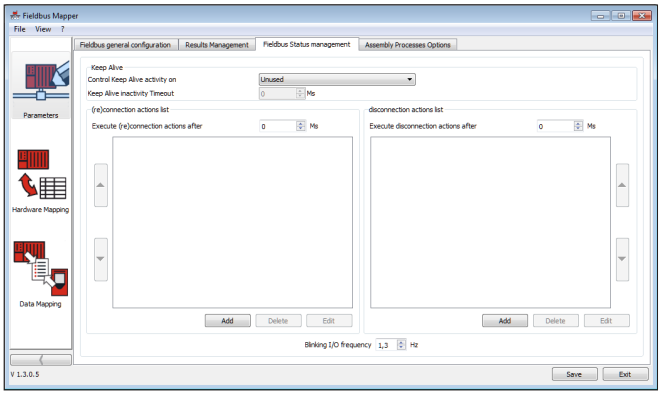
Once a tightening has been done, the result is present in the PLC input memory area. If a new tightening operation starts immediately, the PLC may have too little time to read result values. “Result management” allows to select how to manage results for the PLC.



Several modes are available:

- No management: there is special behavior about result management.
- Holding time management: result remains in memory during a certain amount of time.

4.3 - Connection / disconnection management



This panel is dedicated to set the behavior expected from CVI3 when connection and disconnection events are occurring.

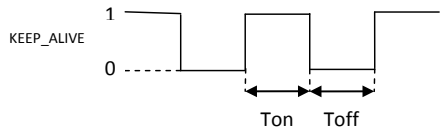
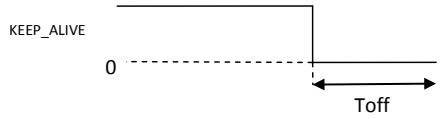
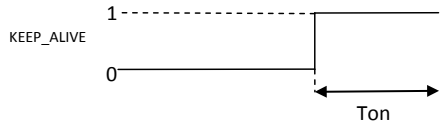
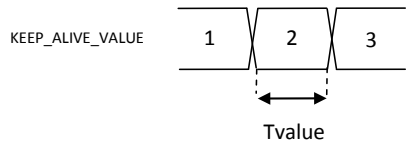
4.3.1 - Connection / disconnection detection

Connection / disconnection is always detected using:

- detecting missing data from PLC.

In addition, a keep alive signal coming from the PLC (input KEEP_ALIVE or KEEP_ALIVE_VALUE) can be supervised by CVI3.

When "keep alive activity" control is enabled, the user must specify the "keep alive inactivity" timeout. Once this duration is expired without new keep alive activity, the disconnection actions are executed. When "keep alive activity" is detected AND data from PLC are present, (re)connection actions are executed.

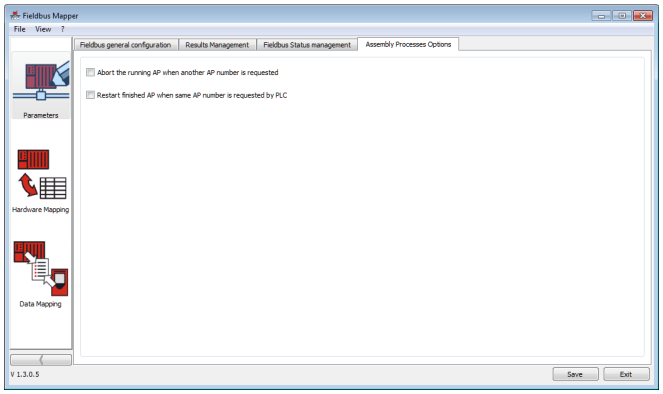
Keep alive mode	Behaviour
Unused	No keep alive control
Bit change	If there is no change in “keep alive” input during a duration longer than “keep alive inactivity time out”, then the Fieldbus is considered as disconnected.
	
	Fieldbus is disconnected if Ton or Toff > Timeout.
Bit falling edge	If the input “keep alive” stays at low level during a duration longer than the than “keep alive inactivity time out”, then the Fieldbus is considered as disconnected.
	
	Fieldbus is disconnected if Toff > Timeout.
Bit rising edge	If the input “keep alive” stays at high level during a duration longer than “keep alive inactivity time out”,, then the Fieldbus is considered as disconnected.
	
	Fieldbus is disconnected if Ton > Timeout.
Value change	If the value of variable “keep alive value” does not change during a duration longer than “keep alive inactivity time out”, then the Fieldbus is considered as disconnected.
	
	Fieldbus is disconnected if Tvalue > Timeout.

4.3.2 - Actions

Select assembly process	to abort current AP and select AP given in argument
Set I/O	to set Input or Output given in argument to active state
Reset I/O	to set Input or Output given in argument to inactive state
Blink I/O	to blink Input or Output given in argument when state is offline (blinking frequency is settable by user)
Abort AP	to abort the current AP.
Reset PLC Outputs	to consider that all data coming from PLC are equals to zero.
Force PLC output reading	to force a new read of PLC outputs. Identifiers, which normally need to change to be taken in account, are also forced.

4.4 - Assembly process

When using assembly process with Fieldbus, the user can select some specific behavior associated to the item AP_ SELECTION:



4.4.1 - Abort the running AP when another AP number is requested

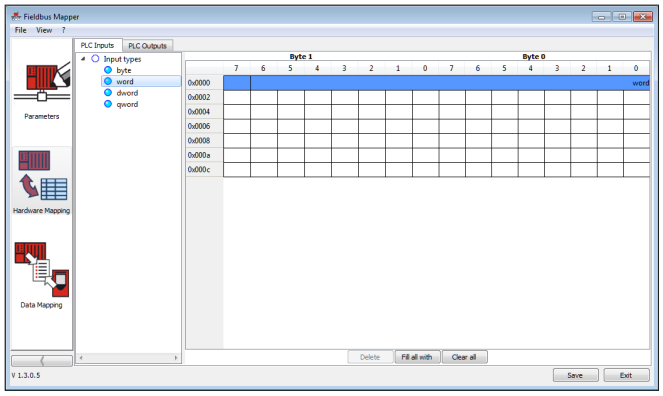
If this item is active, then when PLC select a new AP number, then the current AP is aborted and the requested one is selected.

4.4.2 - Restart finished AP when same AP number is requested by PLC

If this item is active, then when the current AP is finished then the CVI3 will select the AP requested by PLC even if its value did not change since AP start.

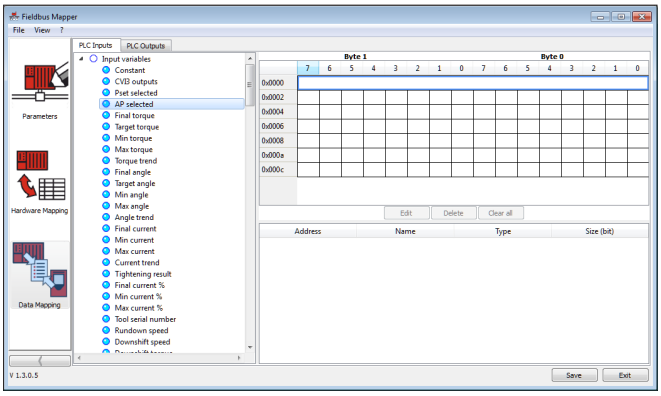
5 - HARDWARE MAPPING

- Click on the icon "Hardware mapping" to display the following screen:



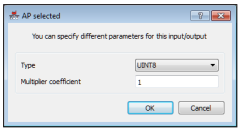
6 - DATA MAPPING

- Once the hardware mapping has been defined, click on "Data mapping" to enter the screen:



- Drag and drop the variables to the selected address.

The following screen appears:



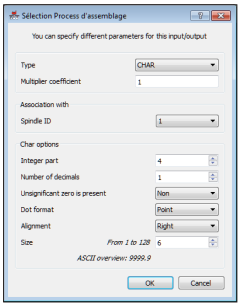
6.1 - Data type

- Choose the type of the data representation in memory:

Format	Description	Size (bytes)
Float	Floating point (IEE754)	4
Char	ASCII string	1..128
Uint32	Unsigned 32 bits	4
Uint16	Unsigned 16 bits	2
Uint8	Unsigned 8 bits	1
Sint32	Signed 32 bits	4
Sint16	Signed 16 bits	2
Sint8	Signed 8 bits	1
Bool	Boolean	1
INT16_ DEC16	Integer part on 16 bits + decimal part on 16 bits.	4

6.2 - Char (ASCII string)

If you choose "Char", extra parameters are necessary to set the ASCII string:



The "Size" is automatically computed. However, you can put a value to truncate value in memory.

6.2.1 - UINT32 UINT16 UINT8

Data are represented as unsigned integer binary. If value exceeds the capacity of selected type, then the maximal value of the specified type is used. Negative can not be represented.

Examples:

CVI3 value	Data in PLC memory		
	UINT8	UINT16	UINT32
99,99	99 (0x63)	99 (0x0063)	99 (0x00000063)
-99,99	0 (0x00)	0 (0x0000)	0 (0x0000000000)
999,9	255 (0xFF)	999 (0x03E7)	999 (0x000003E7)
9999	255 (0xFF)	9999 (0x270F)	9999 (0x0000270F)
9999,9	255 (0xFF)	9999 (0x270F)	9999 (0x0000270F)
99999	255 (0xFF)	65535 (0xFFFF)	99999 (0x0001869F)

6.2.2 - SINT32 SINT16 DINT8

Data are represented as signed integer binary. If value exceeds the capacity of selected type, then the maximal value of the specified type is used.

Examples:

CVI3 value	Data in PLC memory		
	INT8	SINT16	SINT32
99,99	99 (0x63)	99 (0x0063)	99 (0x00000063)
-99,99	-99 (0x9D)	-99 (0xFF9D)	-99 (0xFFFFFF9D)
999,9	127 (0x7F)	999 (0x03E7)	999 (0x000003E7)
9999	127 (0x7F)	9999 (0x270F)	9999 (0x0000270F)
9999,9	127 (0x7F)	9999 (0x270F)	9999 (0x0000270F)
99999	127 (0x7F)	16383 (0x7FFF)	99999 (0x0001869F)

6.2.3 - BOOL

Data are represented as a boolean using 1 byte (8 bits) signed integer binary. If value is equal to zero, then value seen by PLC is 0, otherwise value is 1. Negative values cannot be represented using this type.

Examples:

CVI3 value	Data in PLC memory
0	0
99,99	1
-99,99	0
999,9	1
9999	1
9999,9	1
99999	1

6.2.4 - INT16_DEC16

In this format, the integer is expressed in binary format in 16 bits and decimal part in the remaining 16 bits. The total number of digits is 4 and maximum number of digits is 2 which can be summarized as follows:

Digits for integer part	Digits for decimal part
1	2

2	2
3	1
4	0

Negative values cannot be represented using this format.

Examples:

CVI3 value	Data in PLC memory		
	Integer part	Decimal part	Complete value
99,99	99 (0x63)	99 (0x63)	0x00630063
-99,99	0	0 (0x0)	0x00000000
999,9	999 (0x03E7)	9 (0x9)	0x03E70009
9999	9999 (0x270F)	0 (0x0)	0x270F0000
9999,9	9999 (0x270F)	0 (0x0)	0x270F0000

6.3 - Multiplier coefficient

This coefficient is a value which is multiplied with the variable before being copied in memory. For example, you set “Multiplier Coefficient” to 10 ; then if the variable is equal to 2 then PLC will read 20 (=2x10).

6.4 - Inputs variables

Inputs variables are data coming from CVI3 to PLC.

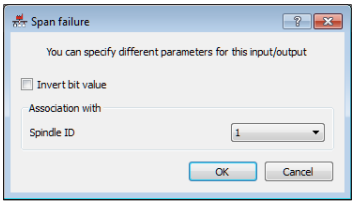
Name	Description	ASCII value	Numerical value	Reset condition	Set condition
Constant	A constant value freely settable by user.			New config loaded	New config loaded
CVI3 outputs	State of the 8 CVI3 outputs			IO change	IO change
Pset selected	Id of Pset currently selected			Pset selection	Pset selection
AP selected	Id of Assembly process currently selected			AP Selection	AP Selection
Final torque	Final torque in Nm (last step)			Tight start	Result received
Target torque	Target torque in Nm (last step)			Tight start	Result received
Min torque	Min torque in Nm (last step)			Tight start	Result received
Max torque	Max torque in Nm (last step)			Tight start	Result received
Torque trend	Torque trend (last step)	" " "<" ">" "="	0 = no result 1 = min 2 = max 3 = accepted	Tight start	Result received
Final Angle	Final angle in degrees (last step)			Tight start	Result received
Target Angle	Target angle in degrees (last step)			Tight start	Result received
Angle trend	Angle trend (last step)	" " "<" ">" "="	0 = no result 1 = min 2 = max 3 = accepted	Tight start	Result received
Final current	Final current in Amps (last step)			Tight start	Result received
Min current	Min current in Amps (last step)			Tight start	Result received
Max current	Max current in Amps (last step)			Tight start	Result received
Current trend	Current trend (last step)	" " "<" ">" "="	0 = no result 1 = min 2 = max 3 = accepted	Tight start	Result received
Tightening result	Tightening result	“A”=accepted “R” = rejected	0 = no result 1 = accepted 2 = rejected	Tight start	Result received

Name	Description	ASCII value	Numerical value	Reset condition	Set condition
Final current %	Final current in % (last step)			Tight start	Result received
Min current %	Min current in % (last step)			Tight start	Result received
Max current %	Max current in % (last step)			Tight start	Result received
Tool serial number	Tool serial number			Tight start	Result received
Rundown speed	Rundown speed in rpm			Tight start	Result received
Downshift speed	Downshift speed in rpm			Tight start	Result received
Downshift torque	Downshift torque threshold			Tight start	Result received
Angle threshold	Threshold (in Nm) used to start angle measure.			Tight start	Result received
Spindle comment	Comment written in tool memory			Tool disconnection	Tool connection
Tool model	Model of tool connected (e.g. EAD50-900)			Tool disconnection	Tool connection
Tool max torque	Maximum torque of tool connected in TU unit.			Tool disconnection	Tool connection
Tool calibration value 1	Calibration value for tool sensor 1 in TU unit.			Tool disconnection	Tool connection
Tool calibration value 2	Calibration value for tool sensor 2 in TU unit.			Tool disconnection	Tool connection
Tool max speed	Tool maximum speed in rpm			Tool disconnection	Tool connection
Result type	Type of the result	0: no result 1: tightening 2: run reverse		Tight start	Result received
User info code	Value of info, error or warning displayed			New user info displayed	No more user info displayed
Keep alive value ack	Mirror of Keep Alive Value in PLC output.			Controller start	New value in keep alive value
User variable 1 ack	Mirror of User Variable 1 in PLC output			Controller start	New value in user variable 1
Controller name	Controller name			Never	CVI3 starts or new config
Tightening unit name	Tightening unit name			Never	CVI3 starts or new config
Socket lifted	Socket lifted (CVI2 or CVI3 socket tray)			Never	Socket lifted
Identifier 1,2,3,4	Identifier stored in result.			Tight start	Result received

6.5 - Events in PLC input

All output events described in CVI3 user Manual can be associated to PLC inputs in Fieldbus.

For each event, you can choose to invert or not the signal.



6.6 - Outputs variables

Name	Description
CVI3 inputs	State of the 8 CVI3 inputs that can be forced by PLC.
Pset selection	Id of Pset expected by PLC
AP selection	Id of Assembly process expected by PLC If the assembly process #0 is requested, then the current assembly process is aborted. CVI3 behavior can be adapted using “Assembly process” panel in general configuration.
Identifier	Identifier (e.g. VIN number), can be used to start an assembly process
Keep alive value	Value that will be copied in Keep Alive Value Ack. Value change can be used as heartbeat management.
User variable 1	A variable freely settable by user. No treatment is made on this value. This value that is copied in User Variable 1 Ack.

6.7 - Events in PLC output

All input events described in CVI3 User Manual can be associated to PLC output in Fieldbus. For each event you can choose to invert or not the signal. Note that you can associate up to 4 input events to a unique bit in PLC output. This allows you to set several events at the same time.

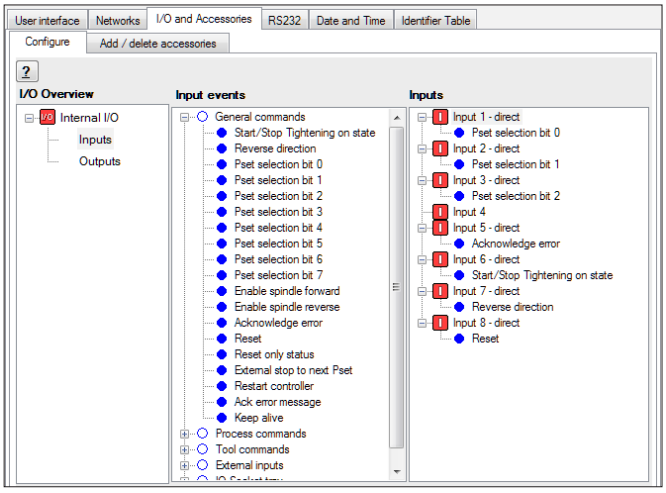
6.8 - Bypass between PLC and IO

For some reasons, you may want to directly control CVI3 inputs/outputs by PLC without any treatment on it.

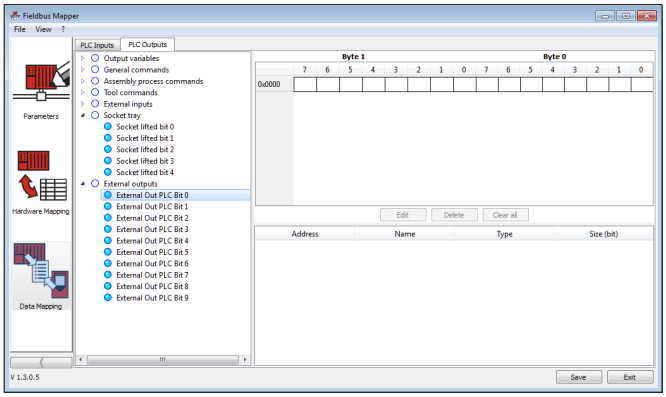
External input/output bits are dedicated to this usage.

Example: to read a CVI3 physical in PLC memory.

- First, associate a CVI3 input to an “External inputs PLC bit” in “I/O and accessories” panel:



- Secondly, associate the “external PLC bit” to the PLC Inputs.

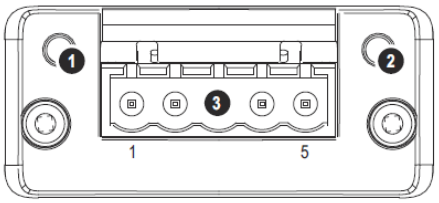


You can now read in PLC the state of CVI3 physical input.

The principle is the same for the outputs.

7 - MODULES DETAILED DESCRIPTION

7.1 - DeviceNet



#	Item
1	Network Status LED
2	Module Status LED
3	DeviceNet Connector

Network Status

State	Indication
Off	Not online / No power
Green	On-line, one or more connections are established
Flashing Green (1 Hz)	On-line, no connections established
Red	Critical link failure

State	Indication
Flashing Red (1 Hz)	One or more connections timed-out
Alternating Red/Green	Self test

Module Status

State	Indication
Off	No power
Green	Operating in normal condition
Flashing Green (1 Hz)	Missing or incomplete configuration, device needs commissioning
Red	Unrecoverable Fault(s)
Flashing Red (1 Hz)	Recoverable Fault(s)
Alternating Red/Green	Self test

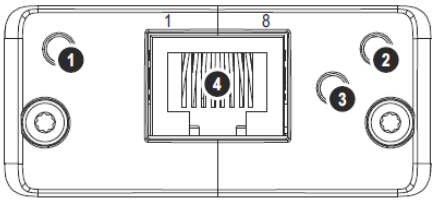
DeviceNet Connector

This connector provides DeviceNet connectivity.

Pin	Signal	Description
1	V-	Negative bus supply voltage *
2	CAN_L	CAN low bus line
3	SHIELD	Cable shield
4	CAN_H	CAN high bus line
5	V+	Positive bus supply voltage *

* DeviceNet bus power. For more information, refer to DeviceNet “Technical Specification”.

7.2 - Ethernet/IP



#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity
4	Ethernet Interface

Network Status LED

A test sequence is performed on this LED during startup.

LED State	Description
Off	No power or no IP address
Green	On-line, one or more connections established (CIP Class 1 or 3)
Green, flashing	On-line, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP Class 1 or 3)

Module Status LED

A test sequence is performed on this LED during startup.

LED State	Description
Off	No power
Green	Controlled by a Scanner in Run state
Green, flashing	Not configured, or Scanner in Idle state
Red	Major fault (EXCEPTION-state, FATAL error etc.)
Red, flashing	Recoverable fault(s)

LINK/Activity LED

LED State	Description
Off	No link, no activity
Green	Link established
Green, flickering	Activity

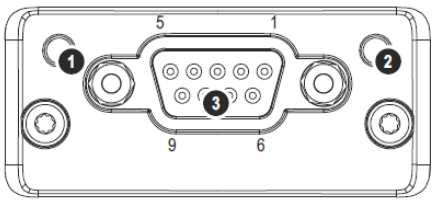
Ethernet Interface

The Ethernet interface supports 10/100Mbit, full or half duplex operation.

CVI3 Ethernet IP module characteristics

Speed	10 and 100Mbits/s supported
Duplex	Half and full supported
EDS file release	2.2
WebServer	Internal webserver in module allowing setting connection parameters (IP address).

7.3 - Profibus



#	Item
1	Operation Mode
2	Status
3	PROFIBUS Connector

Operation Mode

State	Indication
Off	Not online / No power
Green	On-line, data exchange
Flashing Green	On-line, clear

State	Indication
Flashing Red (1 flash)	Parametrization error
Flashing Red (2 flashes)	PROFIBUS Configuration error

Status

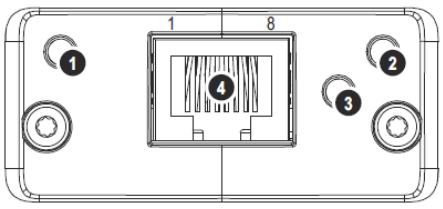
State	Indication	Comments
Off	No power or not initialized	Anybus state = 'SETUP¨' or 'NW_INIT'
Green	Initialized	Anybus module has left the 'NW_INIT' state
Flashing Green	Initialized, diagnostic event(s) present	Extended diagnostic bit is set
Red	Exception error	Anybus state = 'EXCEPTION'

PROFIBUS Connector (DB9F)

Pin	Signal	Description
1	-	-
2	-	-
3	B Line	Positive RxD/TxD, RS485 level
4	RTS	Request to send
5	GND Bus	ground (isolated)
6	+5V Bus Output *	+5V termination power (isolated, short-circuit protected)
7	-	-
8	A Line	Negative RxD/TxD, RS485 level
9	-	-
Housing	Cable Shield	Internally connected to the Anybus protective earth via cable shield filters according to the PROFIBUS standard.

* The current drawn from this pin will affect the total power consumption. To simplify development, the output supplies up to 60mA when operated in room temperature (20 - 22 degrees Celsius), which is sufficient to power e.g. master simulators etc. During normal operating conditions (or higher temperatures), i.e.in an industrial environment, the specified max. current for this output is 10mA.

7.4 - Profinet 1 port



#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity LED
4	Ethernet Interface

Network Status LED

A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Offline	- No power - No connection PLC
Green	Online (RUN)	- Connection with PLC established - PLC in RUN state
Green, flashing	Online (STOP)	- Connection with PLC established - PLC in STOP state

Module Status LED

A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Not Initialized	No power - or - Module in 'SETUP' or 'NW_INIT' state
Green	Normal Operation	Module has shifted from the 'NW_INIT' state
Green, 1 flash	Diagnostic Event(s)	Diagnostic event(s) present
Green, 2 flashes	Blink	Used by engineering tools to identify the node on the network
Red	Exception Error	Module in state 'EXCEPTION'
Red, 1 flash	Configuration Error	Expected Identification differs from Real Identification
Red, 2 flashes	IP Address Error	IP address not set
Red, 3 flashes	Station Name Error	Station Name not set
Red, 4 flashes	Internal Error	Module has encountered a major internal error

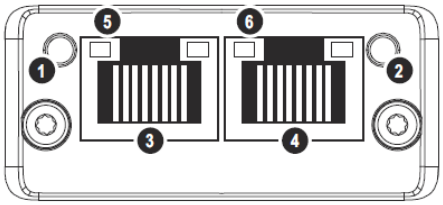
LINK/Activity LED

LED State	Description	Comments
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

Ethernet Interface

The Ethernet interface operates at 100Mbit, full duplex, with auto-negotiation enabled as default.

7.5 - Profinet 2 ports



#	Item
1	Network Status LED
2	Module Status LED
3	Ethernet (port 1)
4	Ethernet (port 2)
5	Link/Activity LED (port 1)
6	Link/Activity LED (port 2)

Network Status LED

A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Offline	- No power - No connection with PLC
Green	Online (RUN)	- Connection with PLC established - PLC in RUN state
Green, flashing	Online (STOP)	- Connection with PLC established - PLC in STOP state

Module Status LED

A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Not Initialized	No power - or - Module in 'SETUP' or 'NW_INIT' state
Green	Normal Operation	Module has shifted from the 'NW_INIT' state
Green, 1 flash	Diagnostic Event(s)	Diagnostic event(s) present
Green, 2 flashes	Blink	Used by engineering tools to identify the node on the network
Red	Exception Error	Module in state 'EXCEPTION'
Red, 1 flash	Configuration Error	Expected Identification differs from Real Identification
Red, 2 flashes	IP Address Error	IP address not set
Red, 3 flashes	Station Name Error	Station Name not set
Red, 4 flashes	Internal Error	Module has encountered a major internal error

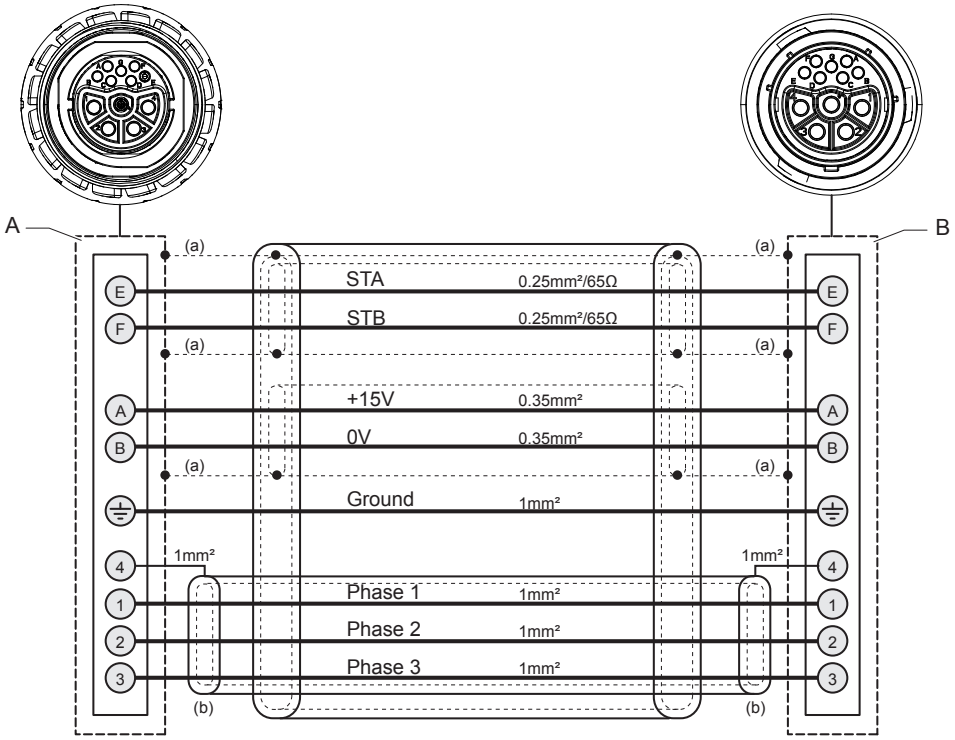
LINK/Activity LED

LED State	Description	Comments
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

Ethernet Interface

The Ethernet interface operates at 100Mbit, full duplex, as required by PROFINET.

1 - TOOL CONNECTOR

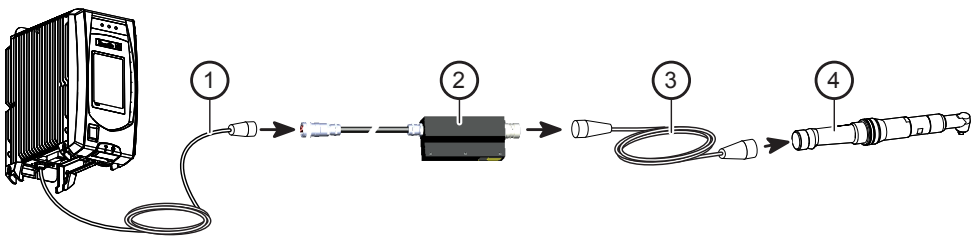


Legend
A Connector 12 pts Male
B Connector 12 pts Female
a Ground shielded cable
b WARNING : Shielded insulate

STA	Twisted pairs: 2x0.25 mm² at 10 MHz 65 Ω
STB	

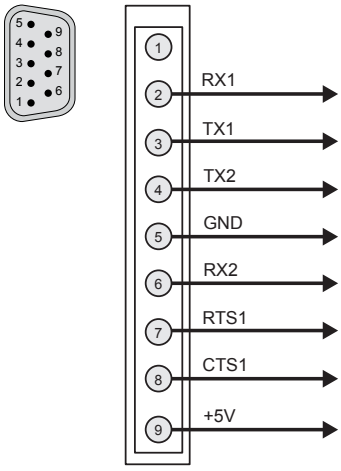
Cable	Color
STA	Red
STB	Red / Blue
+15V	Black / Blue
0V	Black
Ground	Yellow / Green
Phase 1	Black
Phase 2	Brown
Phase 3	Blue

2 - CVI II ADAPTOR

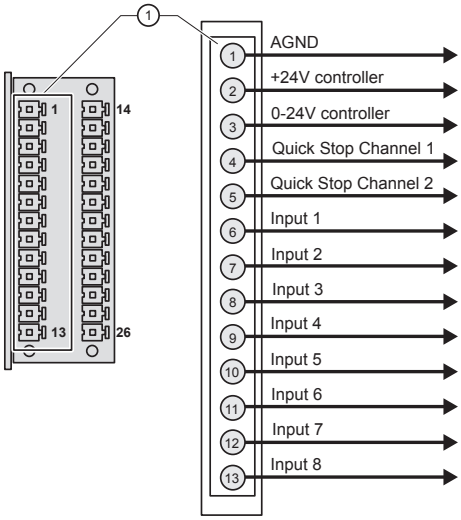


Legend
1 CVI3 tool connector
2 CVI II tool adapter
3 CVI II cable
4 CVI II tool

3 - RS232 - SubD 9pt

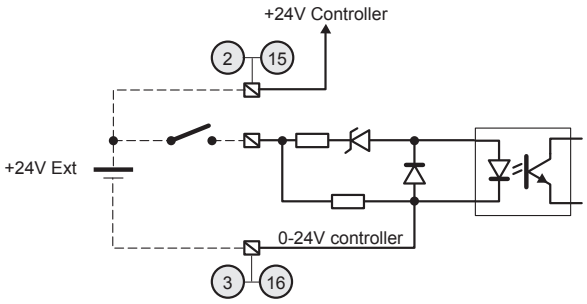


4 - DIGITAL INPUTS (0 – 24V)

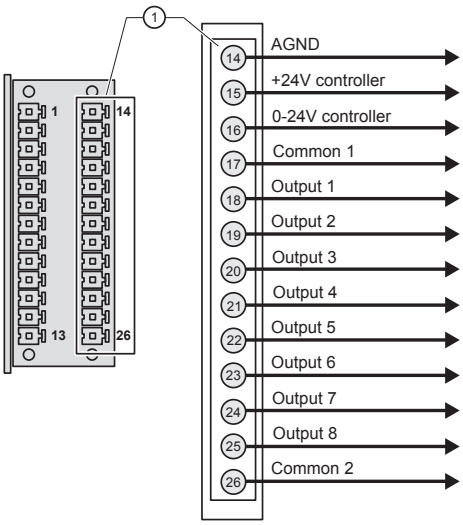


Legend
1 Digital input connector

Example of connections, possibility to connect a 24V external supply in parallel of the 24V delivered by the controller:



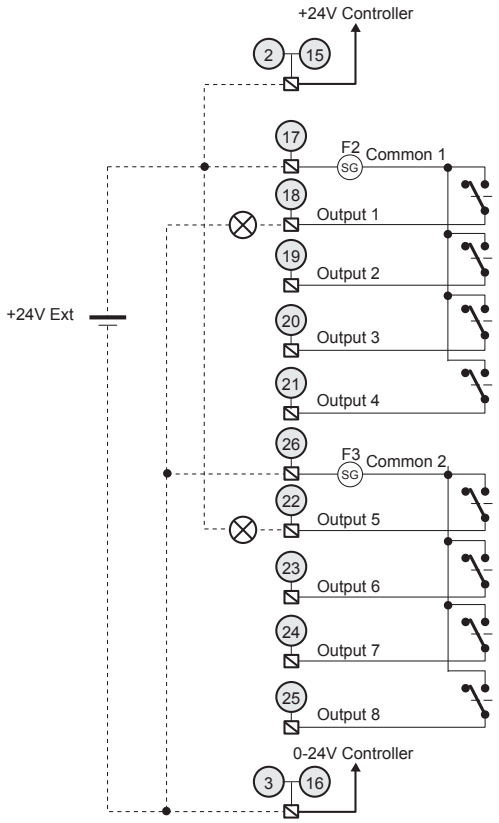
5 - DIGITAL OUTPUTS (0 – 24V)



Legend
1 Digital output connector

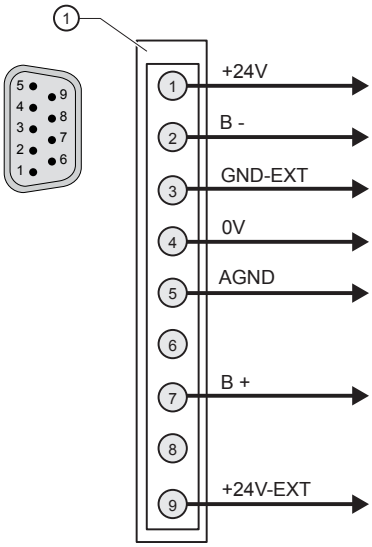
Example of connections:

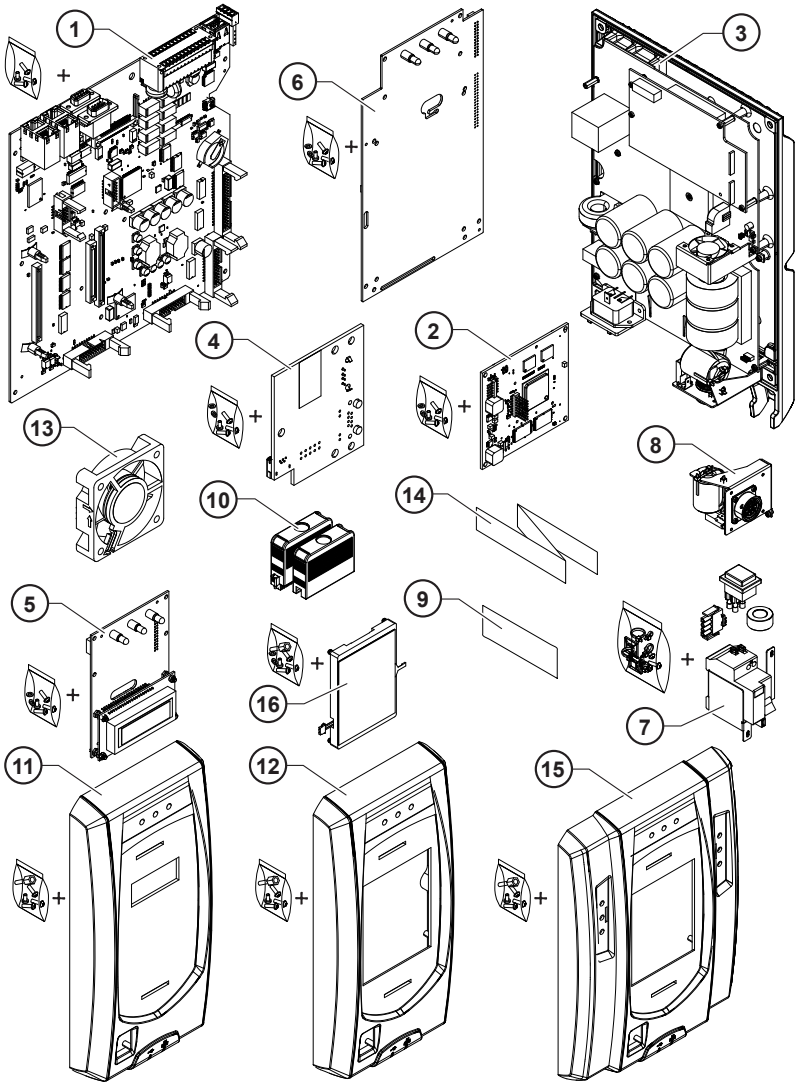
Possibility to connect a 24V external supply in parallel of the 24V delivered by the controller:



6 - EBUS (FOR ACCESSORIES)

6.1 - Port description





Item	Ref.	Designation
1	6159188835	Interface board including screws
2	6159188895	CPU board including screws
3	6153972145	Complete drive board on the heatsink
4	6159188825	Ethernet board including screws
5	6159188815	Display board for CVI3 Function including support and screws
6	6159188535	Display board for CVI3 Vision including the display and screws
7	6159159865	Earth fault circuit breaker including GFI switch, wiring kit and screws
8	6159380555	Tool connector kit
9	2050478153	Warning label
10	6159285025	I/O connector kit
11	6155731425	CVI3 Function front panel including screws
12	6155731435	CVI3 Vision front panel including screws
13	-	Drive board fan
14	-	Flat cable for Interface board / Drive board connection
15	6155731455	TWINCVI3 front panel including screws
16	6159235285	CVI3 Vision display including screws
-	-	TPLC board including screws

More Than Productivity